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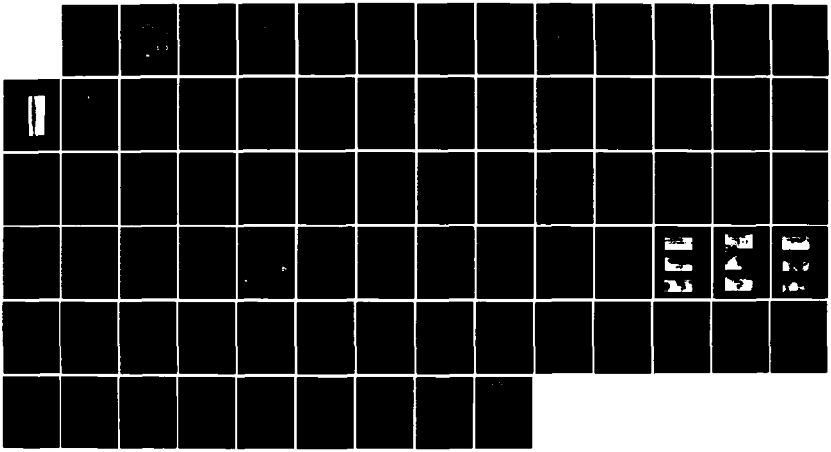

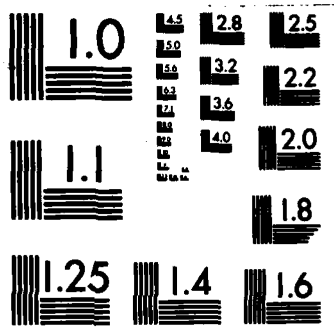

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SAINT JOHN RIVER BASIN
Limestone, Maine

AD-A155 386

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WEBSTER BROOK DAM
ME 00229

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Saint John River Basin
Limestone Maine
LimestoneStream

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The earthfill embankment is 1050 ft. long and 66 ft. high. The embankment dam principal spillway drop inlet, princilpal spillway impact basin and emergency spillway were found in good condition. The dam is classified as intermediate in size with a high hazard potential. No urgent or emergency actions are required for the dam based on this inspection.

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REPLY TO
ATTENTION OF:

NEDED

SEP 23 1981

Honorable Joseph E. Brennan
Governor of the State of Maine
State Capitol
Augusta, Maine 04330

Dear Governor Brennan:

Inclosed is a copy of the Webster Brook Dam (ME-00229) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is vitally important.

Copies of this report have been forwarded to the Department of Agriculture and to the owner, Town of Limestone. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Agriculture for your cooperation in in this program.

Sincerely,

C. E. Edgar III

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

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As stated

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WEBSTER BROOK DAM

ME 00229

ST. JOHN RIVER BASIN
LIMESTONE, MAINE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.	:	ME 00229
Name of Dam	:	Webster Brook Dam (Trafton Lake)
Town	:	Limestone
County & State	:	Aroostook, Maine
Stream	:	Limestone Stream
Date of Inspection	:	November 6, 1979

BRIEF ASSESSMENT

Webster Brook Dam is an eleven year old recreational and flood water retarding structure designed by the USDA Soil Conservation Service. The earth fill embankment is 1050 feet long and 66 feet high. The downstream slope, the crest, and the upstream slope above the recreation pool are grass covered. A reinforced concrete drop inlet principal spillway leads to a 30 inch diameter reinforced concrete conduit under the dam that ends in a reinforced concrete impact basin. A grass lined earth cut emergency spillway is provided at the left abutment. A normal pool of small to intermediate size (approximately 51' deep and 1,700 ac.-ft.) is maintained behind the dam.

The embankment dam, principal spillway drop inlet, principal spillway impact basin and emergency spillway were found in good condition. In the embankment itself, there were no dips, sags or other evidence of distress. The reinforced concrete structures were sound with no evidence of deterioration. The grass cover on the downstream embankment, crest and emergency spillway were well developed. The grass cover on the upstream face was very sparse. Stagnant water was observed at the toe of the downstream slope to the right of the downstream outlet structure.

Based on a maximum storage of 6080 acre-feet and a height of 66 feet, Webster Brook Dam falls within the intermediate size classification. The dam's hazard classification has been established as high based on the potential for loss of more than a few lives in the event of a dam failure. The test flood was estimated for the 4.06 square mile drainage area of rolling terrain using the "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Safety Investigations", New England Division Corps of Engineers, March 1978. The test flood was the PMF. This yielded a peak inflow of 5140 cfs (1270 csm) and a routed peak outflow of 2680 cfs. The computed maximum reservoir level El. 590.4 NGVD was below the embankment crest El. 595 NGVD and no overtopping of the

embankment would occur. The capacity of the dam is greater than 100% of the test flood.

No urgent or emergency actions are required for Webster Brook Dam based on this inspection. Remedial measures include monitoring the project during periods of intense rainfall, developing a downstream warning system, establishing a monthly visual inspection program and conducting bi-annual technical inspections of the dam.

J.E. Giles, Jr.

J.E. Giles, Jr., P.E.
Project Manager
Massachusetts Registration No. 1643

This Phase I Inspection Report on Webster Brook Dam (ME-00229) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

JWFinegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, MEMBER
Geotechmical Engineering Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservior was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project compliance with OSHA rules and regulations is also excluded.

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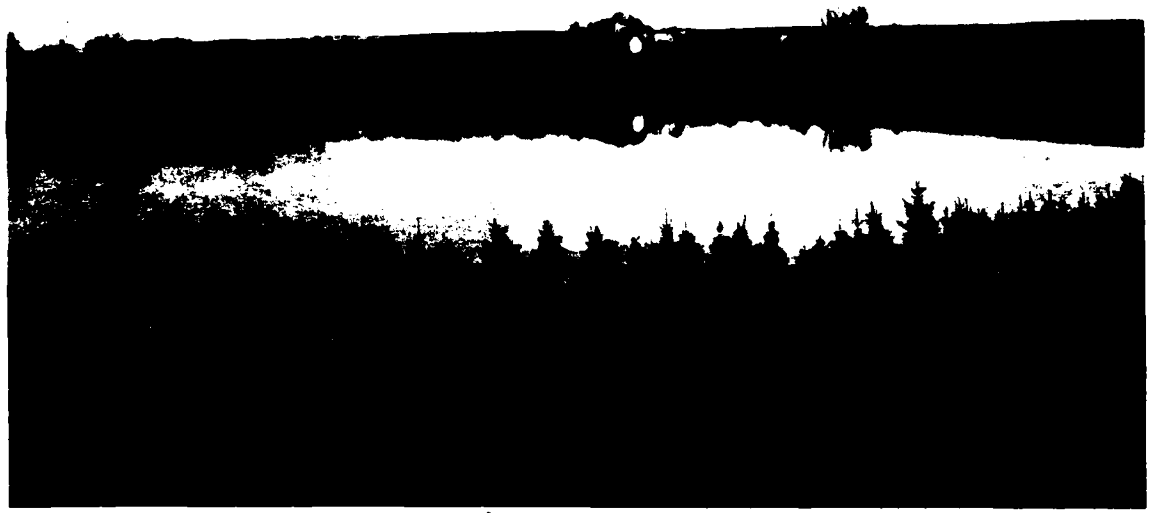
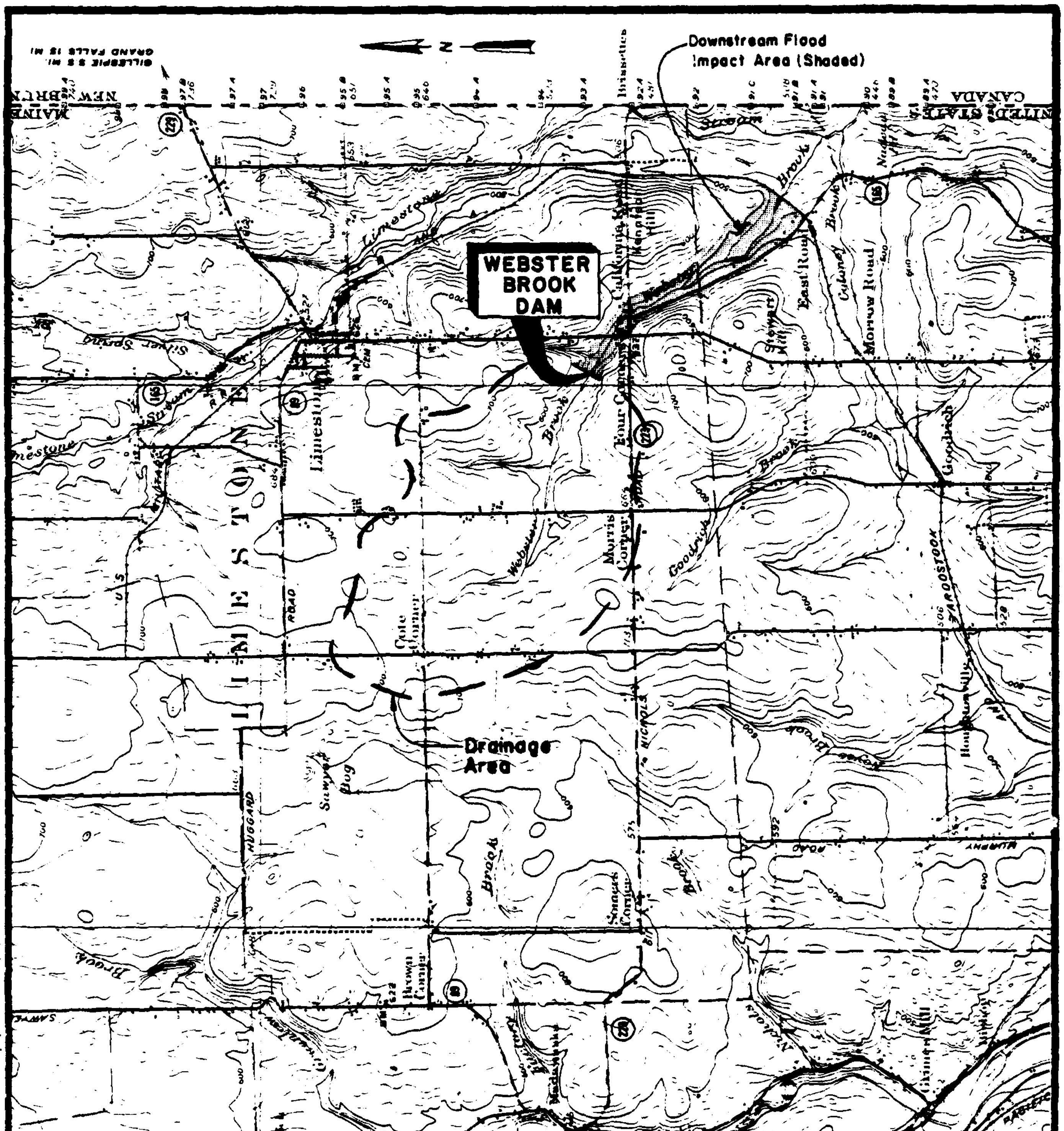
APPENDIXES

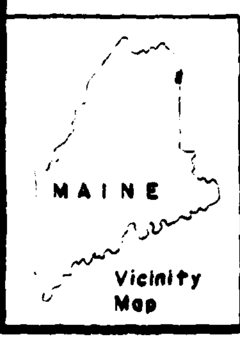


WEBSTER BROOK DAM

VIEW FROM RIGHT BANK OF RESERVOIR



FROM: USGS FORT FAIRFIELD, ME.
QUADRANGLE MAP



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WEBSTER BROOK DAM
LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

DATE November, 1980		
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MAIN

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

WEBSTER BROOK DAM, LIMESTONE MAINE
TRAFTON LAKE

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Maine. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of November 6, 1979 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0011 has been assigned by the Corps of Engineers for this work.

b. Purpose - The purposes of the inspection program are:

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

(1) Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 Description of Project

a. Location - The Webster Brook Dam is located on Webster Brook, approximately 2.5 miles above its confluence with Limestone Stream. The dam is approximately 2 miles south of the Town of Limestone, Maine. The small community of Four Corners lies approximately 1/2 mile directly downstream from the dam. The impounded water is known as Trafton Lake. The site is included on the U.S.G.S. 7.5 minute series Quadrangle, "Limestone, Maine", with approximate coordinates of N46°52'44", W67°49'53". (Also found on the U.S.G.S. 15 minutes series Quadrangle, "Ft. Fairfield, Maine.")

b. Description of Dam and Appurtenances - The project is a dual purpose recreation and floodwater retarding structure. It consists of three principal features: an earthfill dam, a principal spillway, and an emergency spillway. The dam is 1050 feet long, 66 feet high, and 20 feet wide at its crest. Material excavated from the reservoir area was used for the fill in the dam. The upstream slope is 3:1 and the downstream slope is 2.5:1. The fill materials are of glacial till origin with zoning limited to placing the more impervious material in the core and the more pervious material in the outside shells. The structure has a toe drain system with collector pipes and a central cutoff trench.

The principal spillway is an ungated drop intake to a 30 inch diameter reinforced concrete pipe under the dam. The 30-inch pipe is provided with anti-seep collars and discharges into a reinforced concrete impact basin (energy dissipator). The emergency spillway is an excavated, grass lined, earth channel adjacent to the left abutment. The contour of the property on the downstream side of the emergency spillway allows for flows through this spillway to be carried away from the dam. The emergency spillway is 100 feet wide at the crest with an elevation of 588.6 feet NGVD and approximately 2 horizontal to 1 vertical side slopes. The dam is equipped with a 18" gated reservoir drain. The normal recreation pool is maintained at a constant elevation by a 1'-10" x 1'-10" ungated overflow opening in

the principal spillway riser. This orifice (Invert Elev. 580.0 NGVD) is a double opening, each being 7.5 feet wide by 1.25 feet high with a 6" radius weir. The maximum depth of the reservoir is normally 51 ft.

Plans, profiles, and sections of the dam and its appurtenent structures are included in Appendix B. Photographs are shown in Appendix C.

c. Size Classification - The maximum embankment height is 66 feet above the stream channel and the maximum storage is 6080 acre feet at El. 595.0 NGVD. This gives the dam an intermediate size classification based on both the storage and the height (greater than 10,000 ac-ft or higher than 40 ft and less than 50,000 ac-ft and 100 ft). This is in accordance with the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification - This facility is classified as a high hazard potential dam based on the potential for loss of more than a few lives in the event of a dam failure. The dam breach analysis shows that in the small community of Four Corners (approximately 3000' immediately downstream) at least six houses would be impacted with a flood wave having an initial depth of approximately 25'-30'.

e. Ownership - The dam and associated works are owned by the Town of Limestone, Maine.

f. Operators - The project is designed for unsupervised operation. No manual operations are required to pass a flood flow. The project is operated and maintained by the Town of Limestone, Maine. The responsible person is Mr. Thomas Stevens, Town Manager, Limestone, Maine 04750, Telephone (207) 325-3131. (At the time of the field inspection the Town Manager was Mr. Peerless J. Snow).

g. Purpose of Dam - The project is a dual purpose recreation and floodwater retarding structure of standard USDA SCS design. The reservoir is maintained at El. 580 (1700 ac. ft.) for fish and recreation purposes.

h. Design and Construction History - The project was designed by the USDA Soil Conservation Service, Orono, Maine; constructed by H. E. Sargent, Inc., Stillwater, Maine; and completed in 1969. No post-construction changes are reported or observed.

i. Normal Operating Procedures - The reservoir is normally maintained at El. 580 NGVD for recreation purposes. All flood flows are passed through the principal and emergency spillways which are designed for uncontrolled discharge. If the reservoir level drops below El. 580 the 18" drain can be opened to allow downstream flow to continue. No other operating procedures are in evidence.

1.3 Pertinent Data

a. Drainage Area - Webster Brook Dam controls a drainage area of 4.06 square miles. The watershed is approximately 35 percent wooded and 65 percent agricultural. The slopes are gentle with one small marshy pond area upstream. The elevation range of the watershed is from 720' to 530' NGVD.

b. Discharge at Damsite

(1) Outlet Works - The high-stage principal spillway orifice is a double opening (each is 7.5 feet wide x 1.25 feet high) with a sill at Elev. 585.0 NGVD. This ungated orifice opens into a vertical concrete riser that discharges through a 30" diameter concrete conduit, invert Elev. 530.0 NGVD. A 1'-10" x 1'-10" low-stage ungated opening in the riser shaft controls the recreation pool elevation, holding it to Elev 580 NGVD during normal conditions. The emergency spillway is an excavated, grass lined, earth channel with a crest at El. 588.6 NGVD. A screw operated sluice gate and 18"Ø CMP provide the capability to drain the reservoir to El. 531.0 NGVD. This 18" drain discharges into the 30" conduit.

(2) Maximum known flood - Unknown.

(3) Principal spillway capacity at top of dam - N/A.*

(4) Principal spillway capacity at emergency spillway crest elevation - 190 cfs.

(5) Gated spillway capacity at normal pool elevation - N/A.

(6) Principal spillway capacity at test flood elevation - 193 cfs.

(7) Emergency spillway capacity at test flood elev. - 2680 cfs @ El. 590.4 NGVD.

(8) Total project discharge at top of dam - N/A.*

(9) Total project discharge at test flood elevation - 2680 cfs @ 590.4 NGVD.

* Note: This has not been determined since the PMF never reaches the top of the dam.

c. Elevations (feet above NGVD)

(1)	Streambed at toe of dam	529.0
(2)	Bottom of cutoff	524.0
(3)	Maximum tailwater	Not available

(4) Normal pool (Max. Depth = 51')	580.0
(5) Full flood control pool	588.6
(6) Principle spillway crest	
(a) low stage	580.0
(b) high stage	585.0
(7) Emergency spillway crest	588.6
(8) Design surcharge (Original Design)	589.5
(9) Top of dam	595.0
(10) Test flood surcharge	590.4

d. <u>Reservoir</u> (Length in feet)

(1) Normal pool	4600
(2) Flood control pool	5850
(3) Spillway crest pool @ Elev. 585.0	4870
(4) Top of dam	7500
(5) Test flood pool	6800

e. <u>Storage</u> (acre-feet)

(1) Normal pool	1700
(2) Flood control pool	3500
(3) Spillway crest pool @ Elev. 585.0	2600
(4) Top of dam	6080
(5) Test flood pool	4110

f. <u>Reservoir Surface</u> (acres)

(1)	Normal pool	104
(2)	Flood-control pool	144
(3)	Spillway crest	124
(4)	Test flood pool	153
(5)	Top of dam	193

g. <u>Dam</u>

(1)	Type	Earthfill
(2)	Length	1050 feet
(3)	Height	66 feet
(4)	Top Width	20 feet
(5)	Side Slopes	Upstream 3 Hor. to 1 Vert. Downstream 2.5 Hor. to 1 Vert.
(6)	Zoning	2 zones
(7)	Impervious Core	Most impervious toward the core
(8)	Cutoff	5' trench
(9)	Grout curtain	None
(10	Other	N/A

h. <u>Diversion and Regulating Tunnel</u> - None

i. <u>Spillway</u>

(1) Type - Reinforced concrete riser to 30" ϕ conduit

(2) Length of weir - 7.5 feet x 2

(3) Crest elevation - El. 585.0

(4) Gates - ungated

(5) U/S Channel - N/A

(6) D/S Channel - Natural

(7) General - Reinforced Concrete Impact Basin at Outfall

Items Numbered 8 through 10 refer to the Emergency Spillway

(8) Crest - El. 588.6

(9) Length of crest - 100 feet

(10) U/S Channel - Grass lined earth channel

(11) D/S Channel - Grass lined earth channel

(12) General - 2 Hor. to 1 Vert. side slopes

j. Regulating Outlets

(1) Invert - El. 531.0

(2) Size - 18" ϕ CMP

(3) Description - Sluice gate to drain reservoir

(4) Control Mechanism - 18" ϕ Sluice gate w/screw operator

(5) Other - 1' 10" x 1' 10" ungated low stage overflow opening in principle spillway riser; invert elevation 580.0'.

SECTION 2

ENGINEERING DATA

2.1 Design

As built drawings of Webster Brook Dam are on file at the GSA Federal Archives and Records Center, 380 Trapelo Road, Waltham, MA 02154 (617-223-2657). Design calculations and specifications were not available. The December 1964 Limestone Stream Watershed Work Plan indicates that:

> ". . .hydrology and hydraulics analyses followed procedures given in the National Engineering Handbook of the Soil Conservation Service, Section 4, Supplement A, Hydrology (NEH 4A) and Section 5, Hydraulics (NEH 5)."

and for civil works:

> "All designs are in accord with the latest Soil Conservation Service design criteria as set forth in Engineering Memoranda SCS-27, 31, 4D and 42; Technical Release No. 10; Section 3.21, Hydrology, Supplement A of the National Engineering Handbook; U.S. Weather Bureau Technical Paper No. 40; and other sources of recognized engineering material."

2.2 Construction

The Webster Brook Dam and appurtenances were constructed in 1969 by H. E. Sargent, Inc. of Stillwater, Maine. No construction records or photographs were available to the inspection team. A set of "as built" construction prints pertinent to this report are included in Appendix B.

2.3 Operation

No formal operational procedures were available for review. The principal and emergency spillways are uncontrolled structures requiring no manual operations.

2.4 Evaluation

a. Availability: The following information was made available by the SCS, Orono, Maine, office:

(1) As-built drawings (Appendix B).

(2)Limestone Steam Watershed Work plan, by Central Aroostook Soil Conservation District, December 1964.

(3) Information storage and retrieval data (Appendix E.)

Other pertinent engineering data such as the original design calculations are stored at the Federal Records Center in Waltham, Massachusetts and were not readily available.

b. Adequacy: The lack of design calculations did not allow for a definitive review. Evaluation is based on visual inspection, past performance history and engineering judgment and experience.

c. Validity: The limited data available restrict evaluation of the Webster Brook Dam and appurtenances to the visual inspection and engineering judgment. The field inspection indicated that the external features of Webster Brook Dam substantially agree with those shown on the available plans.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General - The field inspection was conducted by L. Seward and J. Jonas of Chas. T. Main, Inc. on 6 November 1979, and J.E. Giles, Jr. on August 12, 1981. On the date of inspection, the Webster dam and appurtenances were in good condition. No urgent or emergency actions are required at this time.

b. Dam

(1) Crest - The embankment crest was true to line with no apparent dips, sags, cracks or other evidence of distress (Photo 1). The top of the settled dam is given as Elev. 595.0 NGVD (see drawing 7 of 21, page B-8). The top of the "constructed dam" is given at Elev. 597.0' NGVD (see drawing 4 of 21, page B-5). This 2 foot variance at the center of the dam was designed so as to allow for the natural settlement of the structure over the lifetime of the project. The visual inspection shows the crest to have a slight crown which is in agreement with the as-built drawing (Photo 1). The crest is grass covered with no pavement.

(2) Upstream slope - The upstream slope riprap appeared in good condition. The slope above the normal pool El. 580 has a sparse grass cover. There was no evidence of sloughing or erosion on the slope.

(3) Downstream slope - The downstream slope has a well developed, tight grass cover (Photo 4). No significant gully action was observed on the slope. No slides or sags were observed.

(4) Downstream toe - The downstream toe is generally dry with no boils or seeps observed. Stagnant water was evident to the right of the outlet structure.

(5) Underdrain system - Two 6-inch diameter toe drain collector pipes issue from the dam adjacent to the principal spillway outlet. These outlets had no observed flows.

(6) Instrumentation - No instrumentation was observed.

c. Appurtenent Structures

(1) Principal Spillway - The principal spillway intake (Photo 2 and 3) was observed from shore. The exposed concrete and steel trashrack appeared in good condition.

(2) Outlet works - The outlet impact basin (Photo 5) was found in good condition. All construction joints were tight. No spalling was observed. The reservoir drain inlet was submerged and could not be inspected. The outlet conduit could not be inspected. The control mechanism for the drain was reported to have been recently operated without problems by the Limestone Town Manager.

(3) Emergency spillway - The emergency spillway was clear of debris and in good condition with a well developed grass cover (Photo 7).

d. Reservoir Area - No areas of potential or actual shoreline movement were observed. There is a small pond located in the reservoir headwaters with a small dike separating the two. The top of this dike is at approximate Elev. 585. A 30" Ø corrugated steel conduit connects the two bodies of water. At the end of the conduit is a timber outlet structure (Photo 8).

e. Downstream Channel - The downstream channel (Photo 6) was clear with no evidence of erosion. Further downstream, Webster Brook flows under Center Road and Route 165. It passes under Center Road through two corrugated steel culverts (Photo 9), one at 80" Ø and one at 27" Ø. It passes under Rte 165 through a bridge structure having an opening of 4' x 20' wide.

3.2 Evaluation - In general, the dam and appurtenances are in good condition. The slopes are stable and the crest is in good shape. The concrete structures are sound. No urgent or emergency repairs are required.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General: The principal and emergency spillways are uncontrolled overflow structures. No manual operations are required to insure safe passage of a flood flow.

b. Description of Downstream Warning System: No warning system or emergency evacuation plans are in effect for this project.

4.2 Maintenance Procedures

a. General: The Town of Limestone has an operation and maintenance agreement with the Soil Conservation Service. Each dam is inspected at least once annually and after every major storm. An inspection report is prepared and any required maintenance is then performed by the town.

b. Operating Facilities: There are no manual operating facilities at this structure except for the reservoir drain gate on the principal spillway riser. Recent operation of the drain was reported. No regular maintenance procedures for the project operating facilities are specified.

4.3 Evaluation

The operating and maintenance procedures are limited for this project. The owner should establish procedures to inspect the structures regularly, continue to keep the embankment free of brush and trees, and to monitor the project during periods of intense rainfall.

The owner should arrange to have a technical inspection made on a bi-annual basis. The owner should establish a warning system to follow in the event of emergency conditions.

SECTION 5

EVALUATION OF HYDROLOGIC AND HYDRAULIC FEATURES

5.1 General - The watershed is 4.06 square miles of undeveloped rolling terrain. The dam is located on the Webster Brook, about 2.7 miles upstream from the confluence with Limestone Stream. The dam develops sufficient storage to reduce the Test Flood peak from 5140 cfs (1270 csm) to 2680 cfs (about 48% reduction).

5.2 Design Data - The dam was designed by the Soil Conservation Service, U.S. Department of Agriculture. The original hydrologic/hydraulic design called for the principal spillway to pass the 100 year flood and the emergency spillway to pass the Probable Maximum Precipitation (PMP) storm. The maximum height of the dam is 66 feet (capacity 6080 ac. ft.) and is classified as an intermediate size dam. The principal spillway consists of a reinforced concrete riser, a gated reservoir drain, a 30" diameter conduit with anti-seep collars and an energy dissipating structure at the outlet with a rip-rapped channel. The dam has an emergency spillway located adjacent to the left abutment. The drawings show that the bottom width is 100 feet with a crest at Elev. 588.6 feet. The drawings give the channel depth at the crest as 6.4 feet with channel side slopes of 2:1 (see sketch on page D-10).

5.3 Experience Data - There are no records of past floods or overtopping of the dam.

5.4 Test Flood Analysis - Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March 1978, the watershed classification (rolling), and hydraulic computations, the test flood for this high hazard, intermediate size dam is estimated to be equivalent to the PMF of 5140 cfs. The flood routing starting elevation was selected to be the principal spillway crest elevation (585 ft), and the inflow hydrograph peak was reduced by the volume between emergency spillway crest and principal spillway intake elevations. For this portion of Maine, the Maximum Probable Runoff is assumed to be 13 inches. The routed test flood outflow was determined in accordance with Corps of Engineers "Guidance for Estimating Effect of Surcharge Storage on Maximum Probable Discharges", and the hydraulic characteristics of the dam. Spillway discharge was computed as open channel flow. The routed test flood outflow was determined to be 2680 cfs, and the corresponding water surface elevation 590.4 ft. The top of the dam is 595.0 ft. and thus the dam will not be overtopped. The emergency spillway capacity is more than 100 percent of the test flood. As a check, a second test flood routing was performed assuming weir control in the emergency spillway and the dam was not overtopped.

5.5 Dam Failure Analysis - The volume in the reservoir corresponding to the water surface Elev. 590.4 NGVD is 4110 ac.-ft. which is the value used in this dam failure analysis. The impact of failure of the dam was assessed

using the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" prepared by the Corps of Engineers. The breach discharge was estimated with the maximum water surface elevation during a Test Flood event. The breach width was selected to be 35 percent of the length of the dam at mid-height. The downstream discharge is a sum of the breach discharge and the discharge from the spillway. The total peak discharge was estimated to be 158,396 cfs.

The result of the calculations are included in Appendix D. The conclusion of this dam failure analysis is that at least six houses located approximately 3000' downstream in the small community of Four Corners will be impacted by a flood wave with an initial depth of approximately 25'-30'. (See the Location Map, page vi, for the Downstream Flood Impact Area.) From the USGS map it is estimated that these subject houses are about 10 feet above the streambed. The prefailure channel level in this area was calculated to be approximately 7 feet. Thus, an unexpected dam failure at Webster Brook Dam will result in a potential loss of more than a few lives and serious property damage.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation

The visual inspection on November 8, 1979 revealed no dips, sags, depressions or other evidence of instability.

6.2 Design and Construction Data

Original design calculations and construction records were not available for review in preparing this report. The construction drawings for the dam were reviewed. A typical construction specification for Durepo Brook Dam was reviewed as it was reported to be similar to the Webster Brook specification.

6.3 Post Construction Changes

No evidence of modification to the dam since construction was observed or reported.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 2 and, in accordance with recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - The visual inspection indicates that Webster Brook Dam is in good condition. The inspection revealed that there is a small area of stagnant water to the right of the spillway outlet at the toe with limited seepage observed in this area.

b. Adequacy of Information - The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency - The recommendations and remedial measures presented below should be implemented by the owner within two years of receipt of this Phase I Inspection Report.

7.2 Recommendations - None

7.3 Remedial Measures The owner should:

a. Establish a system to monitor the project during periods of intense rainfall.

b. Develop a downstream warning system to be used in case of an emergency at the dam.

c. Implement a monthly visual inspection program of the dam and its appurtances. Observations should be noted in a maintenance log.

d. Continue to keep the embankment free of brush and trees and continue to keep the grass mowed.

e. Conduct a technical inspection of the project every two years.

f. Obtain and maintain a set of as-built drawings and inspection reports.

7.4 Alternatives

There are no practical alternatives to the recommendations of Sections 7.2 and 7.3.

APPENDIX A

FIELD INSPECTION CHECK LIST

INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Webster Brook Dam
(Trafton Lake)

DATE Nov. 6, 1979
TIME 9:00
WEATHER Fair Cold
U.S. ELEV._____U.S.____DN.S.

PARTY:

1. Lewis B. Seward - Hydrologist
2. Jan N. Jonas - Civil Engineer
3. Peerless J. Snow - Limestone Town Manager
4. J.E. Giles, Jr. - Project Manager on August 12, 1981
5.
6.
7.
8.
9.
10.

PROJECT FEATURE	INSPECTED BY	REMARKS
1. All of the project features were inspected by each of the party members.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

INSPECTION CHECKLIST

PROJECT Webster Brook Dam	DATE Nov. 6, 1979
PROJECT FEATURE Earthfill dam	NAME Lewis B. Seward
DISCIPLINE Hydro	NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	597
Current Pool Elevation	not known
Maximum Impoundment to Date	736 ac.ft
Surface Cracks	none visible
Pavement Condition	grassed slopes with riprap on u/s
Movement or Settlement of Crest	none noticeable
Lateral Movement	none noticeable
Vertical Alignment	good
Horizontal Alignment	no change
Condition at Abutment and at Concrete Structures	no damage to embankment-riprap
Indications of Movement of Structural Items on Slopes	none
Trespassing on Slopes	none
Vegetation on Slopes	thick grass
Sloughing or Erosion of Slopes or Abutments	none
Rock Slope Protection - Riprap Failures	u/s with riprap, d/s grassed - no failure
Unusual Movement or Cracking at or near Toes	none
Unusual Embankment or Downstream Seepage	limited seepage d/s right from outlet - stagnant water at toe
Piping or Boils	none
Foundation Drainage Features	drain holes in both wing walls d/s no water was flowing
Toe Drains	none visible
Instrumentation System	none noticed

INSPECTION CHECKLIST

PROJECT Webster Brook Dam DATE Nov. 6, 1979

PROJECT FEATURE Earthfill Dam NAME Lewis B. Seward

DISCIPLINE Hydro NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Not applicable
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	New concrete - very good
Stop Logs and Slots	none, uncontrolled spillway with trashracks

INSPECTION CHECKLIST

PROJECT Webster Brook Dam DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam NAME Lewis B. Seward

DISCIPLINE Hydro NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	same as intake tower
General Condition	very good
Condition of Joints	tight
Spalling	none
Visible Reinforcing	none
Rusting or Staining of Concrete	none
Any Seepage or Efflorescene	not applicable
Joint Alignment	good
Unusual Seepage or Leaks in Gate Chamber	not applicable
Cracks	none
Rusting or Corrosion of Steel	none
b. Mechanical and Electrical	
Air Vents	none
Float Wells	none
Crane Hoist	none
Elevator	none
Hydraulic System	none
Service Gates	none
Emergency Gates	hand operated gate valve from top of intake structure
Lightning Protection System	none
Emergency Power System	none
Wiring and Lighting System in Gate Chamber	none

INSPECTION CHECKLIST

PROJECT Webster Brook Dam DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam NAME Lewis B. Seward

DISCIPLINE Hydro NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	Concrete pipe embedded in dam not exposed for inspection
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

INSPECTION CHECKLIST

PROJECT	Webster Brook Dam	DATE	Nov. 6, 1979
PROJECT FEATURE	Earthfill dam	NAME	Lewis B. Seward
DISCIPLINE	Hydro	NAME	Jan N. Jonas

AREA EVALUATED	CONDITIONS
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	very good
Rust or Staining	none
Spalling	none
Erosion or Cavitation	none
Visible Reinforcing	none
Any Seepage or Efflorescence	none
Condition at Joints	tights
Drain Holes	at wing walls
Channel	grassed cut slopes
Loose Rock or Trees Overhanging Channel	none
Condition of Discharge Channel	very good - no obstacles, grassed banks

INSPECTION CHECKLIST

PROJECT Webster Brook Dam DATE Nov. 6, 1979

PROJECT FEATURE Earthfill dam NAME Lewis B. Seward

DISCIPLINE Hydro NAME Jan N. Jonas

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	satisfactory - grassed slopes
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	none
Floor of Approach Channel	weathered rock covered with grass
b. Weir and Training Walls	
General Condition of Concrete	no concrete used - earth and rock cut slopes, unpaved floor
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	nothing downstream
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

APPENDIX B

ENGINEERING DATA

Note: 1. All design records are in storage at the:

National Archives and Records Service
GSA Federal Archives and Records Center
380 Trapelo Road, Waltham, Massachusetts 02154
617-223-2657

2. No past inspection reports were available for review or are known to exist.

LIST OF ENCLOSED DRAWINGS

		Sheet Number
1.	Plan of Storage and Borrow Area	2 of 21
2.	Plan of Dam Site	3 of 21
3.	Cutoff Trench Details	4 of 21
4.	Fill Placement and Spillway Excavation	5 of 21
5.	Drainage Details	6 of 21
6.	Principle Spillway	7 of 21
7.	Test Pits Logs	19 of 21
8.	Test Pits Logs	20 of 21

References

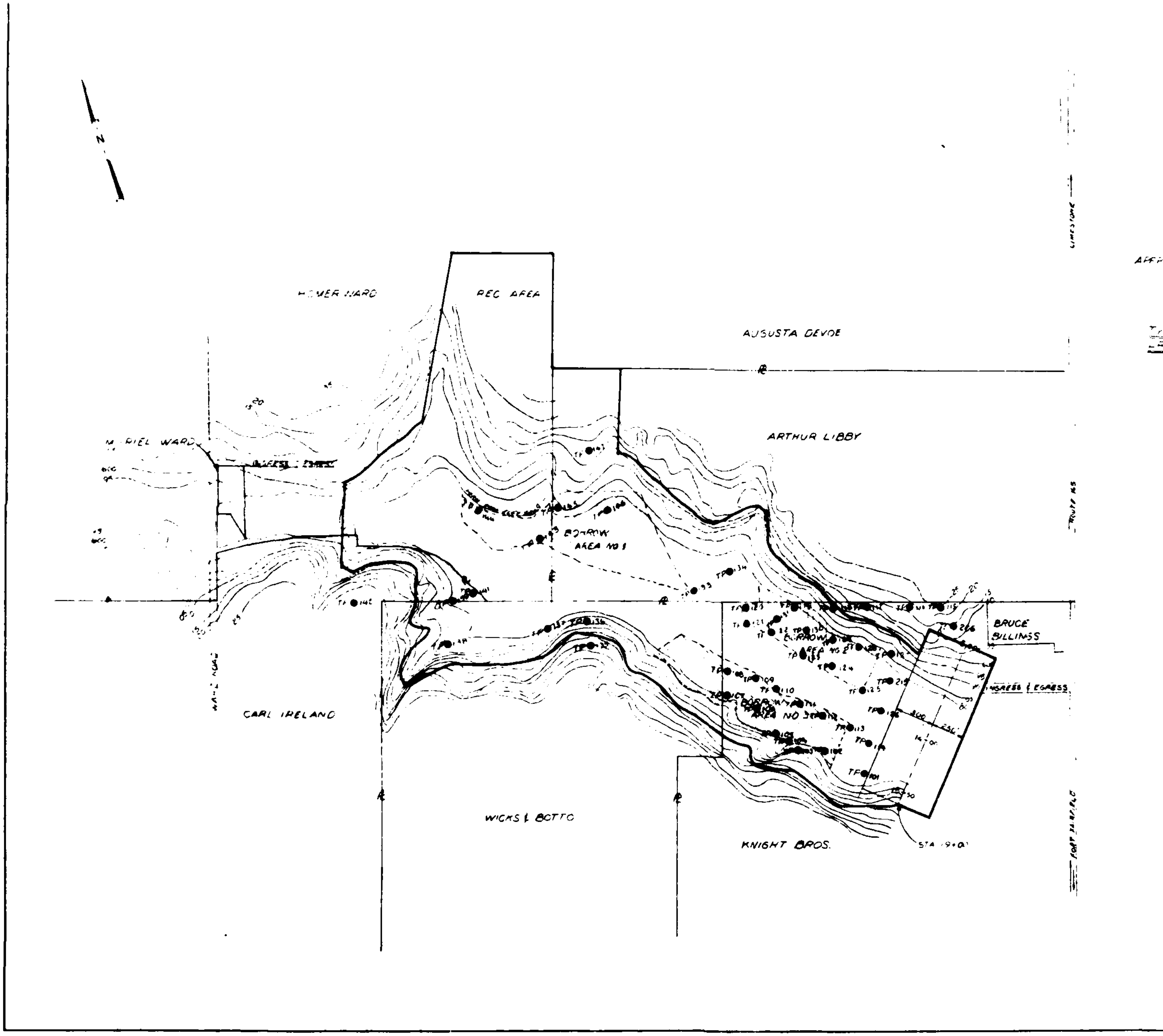
Material from the following references w . extracted and incorporated herein:

a. "Limestone Stream Watershed Work Plan" Central Aroostook Soil Conservation District December, 1964.

b. U.S. Dept. of Agriculture, Soil Conservation Service, "Webster Brook Site Drawings", Project No. ME-504-P, (21 sheets) 1967 series.

c. "Durepo Brook - Invitation to Bid" March 1971 SCS construction specification (Typ.)

d. SCS Technical Information Storage and Retrieval System Printout.



REPRODUCED AT GOVERNMENT EXPENSE

LIMESTONE STREAM WATERSHED PROJ.
MULTI-PURPOSE STRUCTURE DAM NO 3
WEBSTER BROOK SITE
LIMESTONE, MAINE

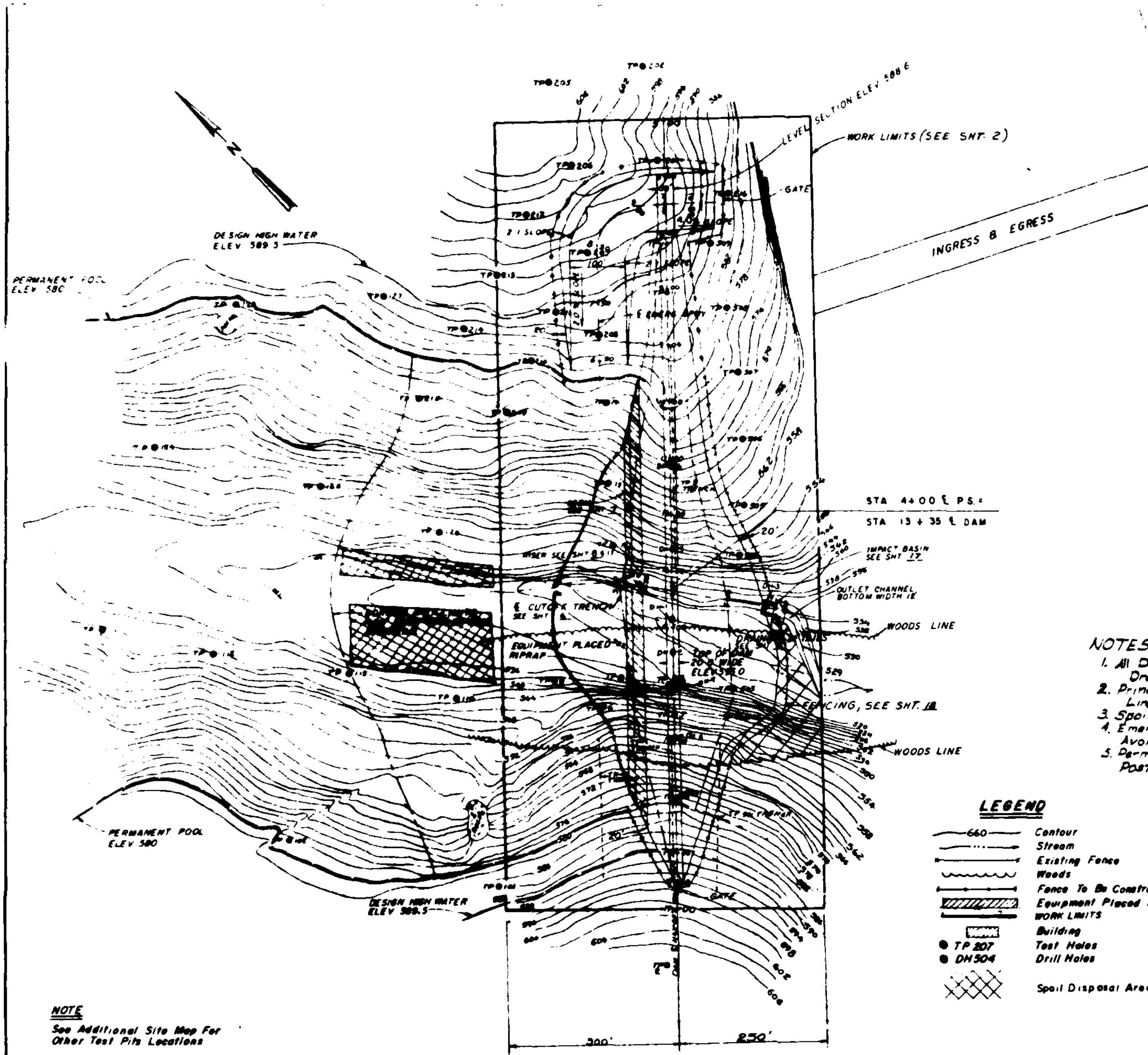
PLAN OF STORAGE & BORROW AREA

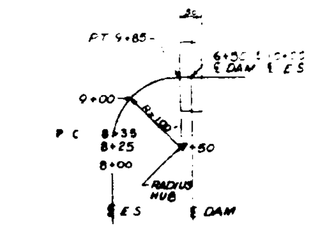
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

G P BOWIE 3-67
M ATLAS 3-67

ME-5C4-P

REPRODUCED AT GOVERNMENT EXPENSE





EMERGENCY SPILLWAY LAYOUT DATA

EMERGENCY SPILLWAY CURVE DATA		
STATION	DEFLECTION	CHORD LENGTH
PC: 8+35	0	
8+85	14°19'	49.50
9+35	28°38'	49.50
PT: 9+85	42°58'	49.50
R = 100'	Δ = 85°56'	

℄ OF ROAD
ROUTE 165
FORT FAIRFIELD

NOTES

1. All Dam Stations Are 50 Right Of Stations On Drawings.
2. Principle Spillway Built At New Sta. 12+91 On Center-Line Of Dam To Keep From Having Rock Excavation.
3. Spoil Material Was Placed Upstream Above Dam.
4. Emergency Spillway Moved 50 Downhill (Right) To Avoid Rock Excavation.
5. Permanent Bench Mark Located On Top Of Concrete Post At Sta. 5+00, Elev 596.93' & At Sta 19+00, Elev. 607.34.

LEGEND

- 660 — Contour
- Stream
- Existing Fence
- Woods
- Fence To Be Constructed
- Equipment Placed Riprap
- WORK LIMITS
- Building
- ● TP 207 — Test Holes
- ● DH 504 — Drill Holes
- Spoil Disposal Area

0 50 100 200
SCALE in feet

NOTE
See Additional Site Map For Other Test Pits Locations

Revised 7/10/67 C

LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUCTURE DAM NO. 3
WEBSTERBROOK SITE
LIMESTONE, MAINE
PLAN OF DAM SITE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed G. P. BOWIE	Date 2-67	Approved by
Drawn M. ATLAS	2-67	
Sheet 3 of 21		ME-504-P

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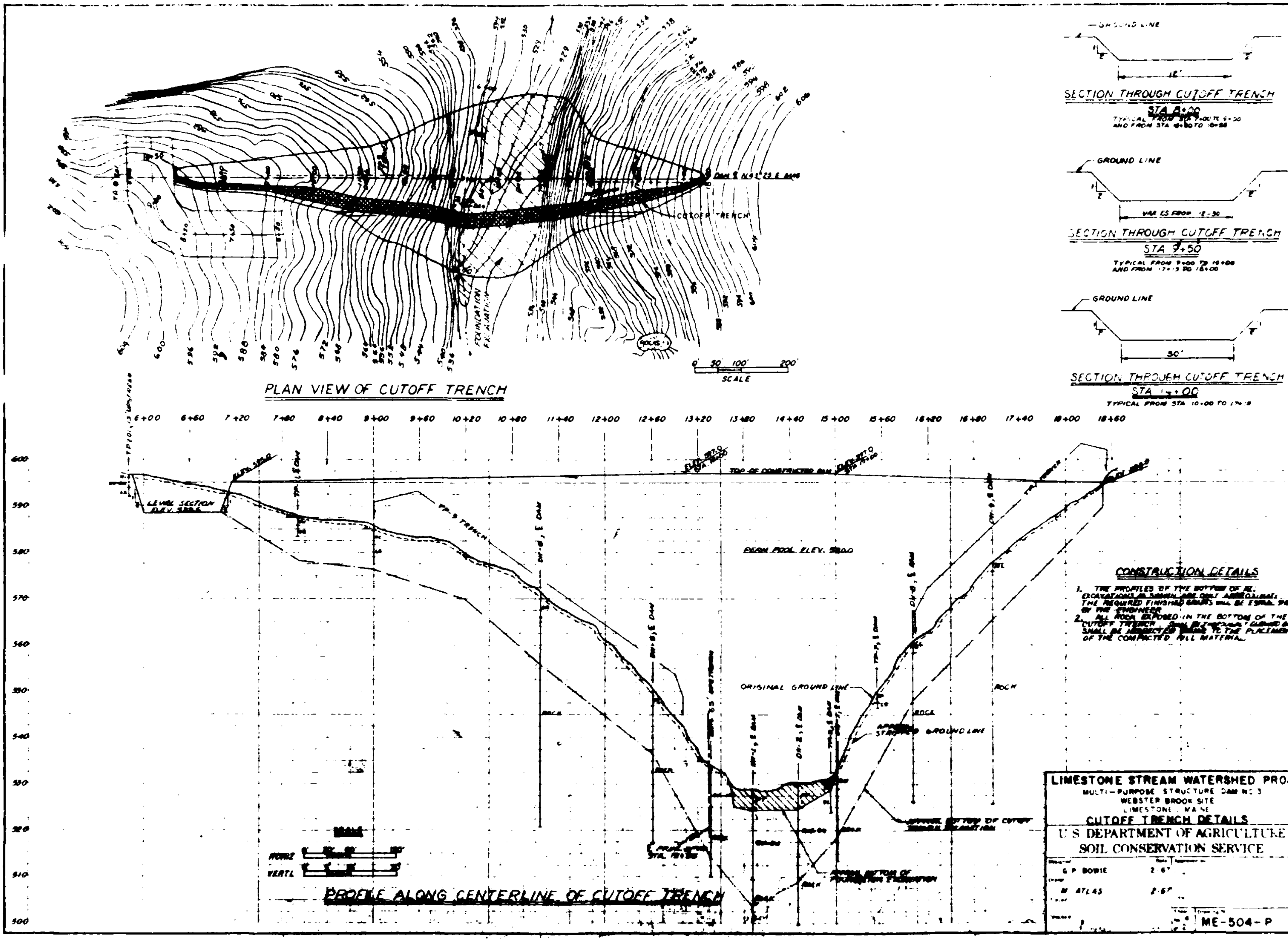

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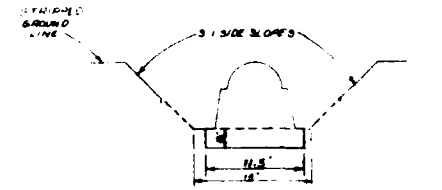
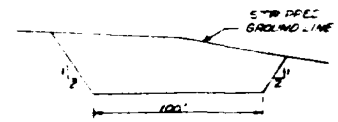
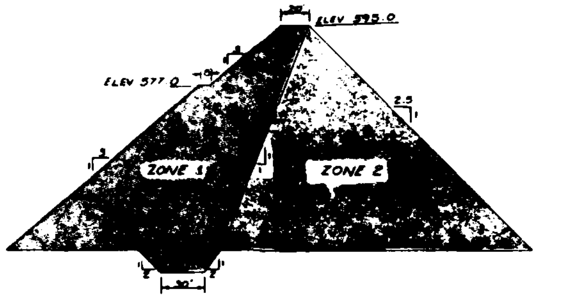


PRINCIPAL SPILLWAY EXCAVATION
AT ANTI-SEEP COLLARS
Not to scale



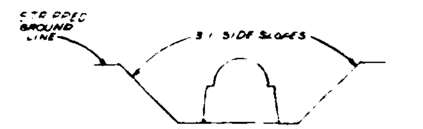
EMERGENCY SPILLWAY EXCAVATION
TYPICAL SECTION AT STA 10+00
Not to scale



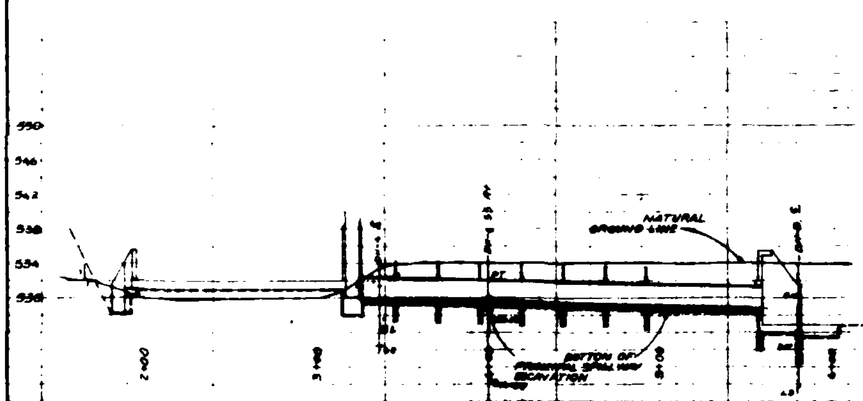
TYPICAL SECTION OF EMBANKMENT AT STA. 14+00
TYPICAL FROM STA. 10+00 TO 17+15

ZONE	MATERIAL	MAX ROCK SIZE	MAX LIFT	REQD H_2O %	COMPACTION	
					CLASS	DEFINITION
1	CLAYEY GRAVEL (GC) FROM BORROW AREA REPRESENTED BY MATERIAL IN TP-146 1-4-5	6"	9" PRIOR TO COMPACTION	-1% TO +2% OF OPTIMUM	A	95% MAX DENSITY BY ASTM D698 METHOD-D
2	SILTY GRAVEL (GM) FROM BORROW AREA REPRESENTED BY MIX, 130.1, 3'-10'	6"	"	-2% TO +2% OF OPTIMUM	A	"

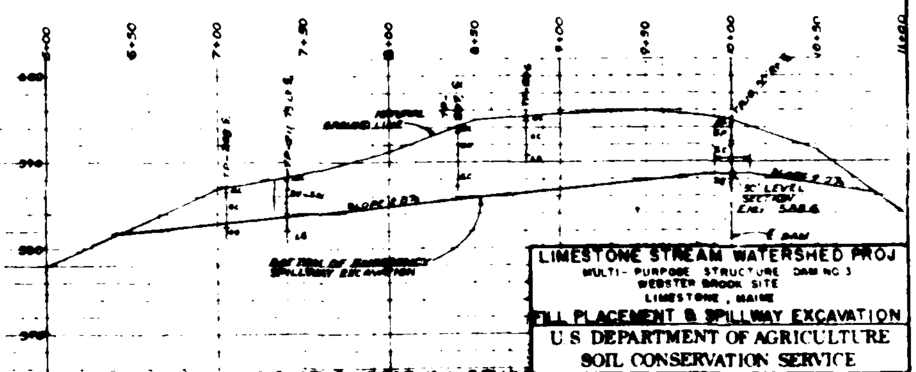
CONSTR. DETAIL
1. THE FOUNDATION SURFACE THROUGHOUT THE BASE OF THE DAM, SHALL BE SCARIFIED TO A DEPTH OF 6" AND COMPACTED PRIOR TO PLACEMENT OF EARTH FILL
2. ZONE 2 MATERIAL TO APPROXIMATE THE PROPORTIONS OF THE MIX WHICH INCLUDES UP TO 3 FEET OF WEATHERED ROCK



PRINCIPAL SPILLWAY EXCAVATION
AT STA 4+00
TYPICAL FROM STA. 1+80 TO 5+36
Not to scale



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY



PROFILE ALONG ℄ OF EMERGENCY SPWY

LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUCTURE DAM NO 3
WEBSTER BROOK SITE
LIMESTONE, MAINE
FILL PLACEMENT & SPILLWAY EXCAVATION
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	G P BOWIE	2-67
Drawn	M ATLAS	2-67
Sheet 3		ME-504-P

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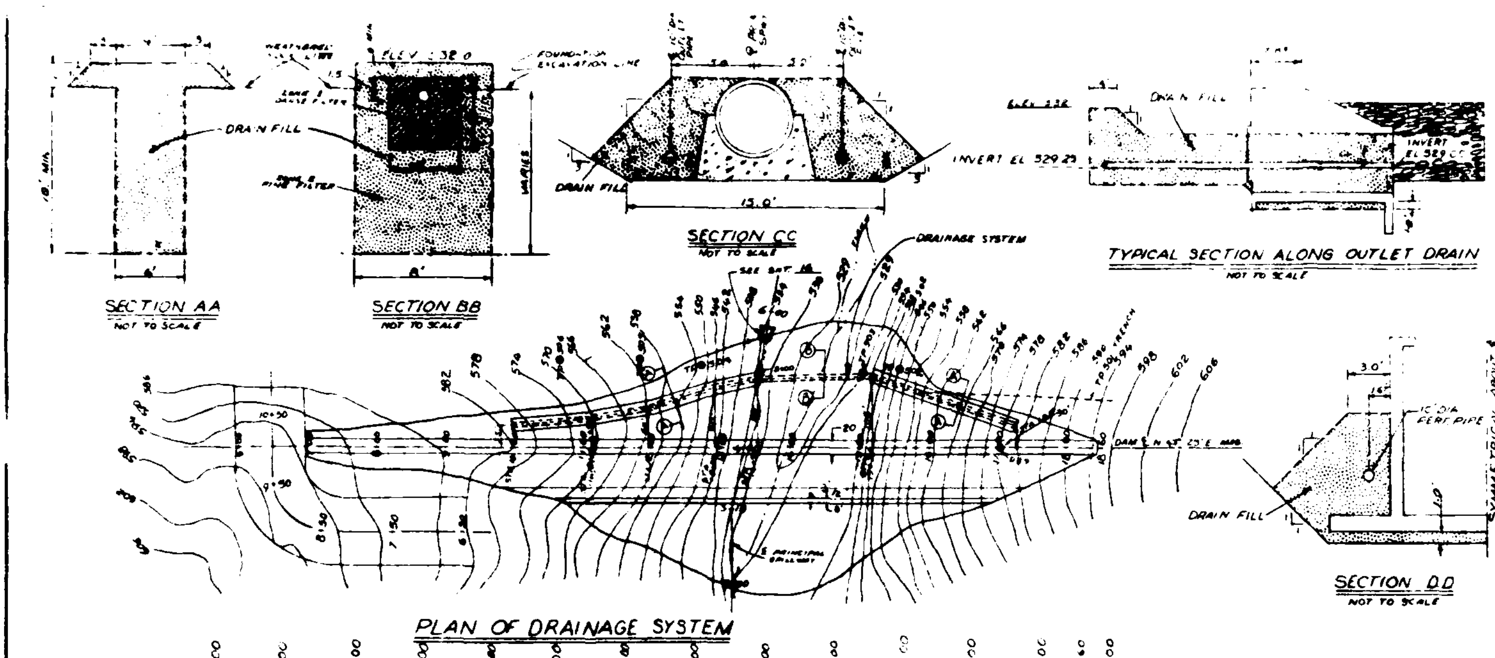
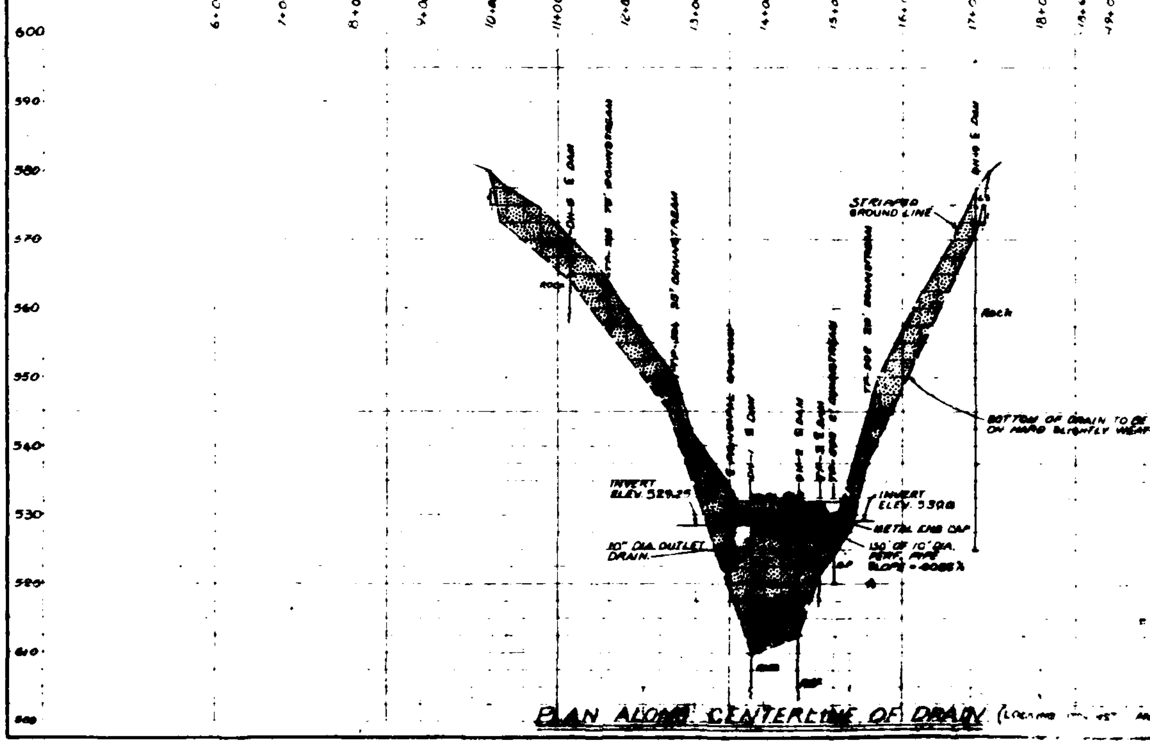
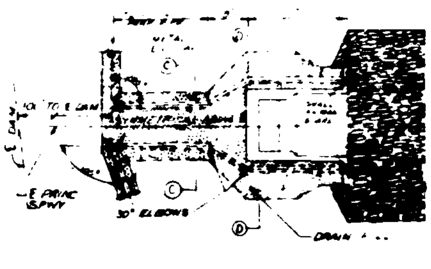






PLAN OF OUTLET DRAIN
NOT TO SCALE

CONSTRUCTION NOTES

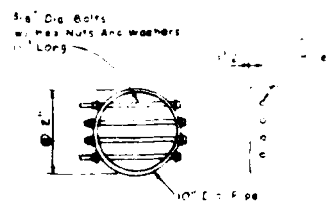
ALL DRAIN PIPE SHALL CONFORM TO SPECIFICATION ... AND SHALL BE ... DIA., 16 GAGE, SHAPE 1 CLASS I TYPE C, PERFORATED PIPE

THE PROFILES OF THE BOTTOM OF ALL EXCAVATIONS AS SHOWN ARE ONLY APPROXIMATE. THE REQUIRED FINISHED GRADES WILL BE ESTABLISHED BY THE ENGINEER

SUMMARY OF QUANTITIES

2115 CU YDS OF DRAIN FILL
298 OF 10" DIA PERFORATED PIPE
4 30° ELBOWS
1 105° ELBOW
2 METAL END CAPS

DESIGN DATA FOR DRAIN FILL		
SIEVE NO	% PASSING	
	ZONE NO 1	ZONE NO 2
5"	100	
3/4"	70-100	
NO 4	15-62	80-100
NO 10	-33	65-95
NO 20	0-4	42-71
NO 40	0	22-88
NO 60		6-38
NO 100		0-24
NO 200		0-5



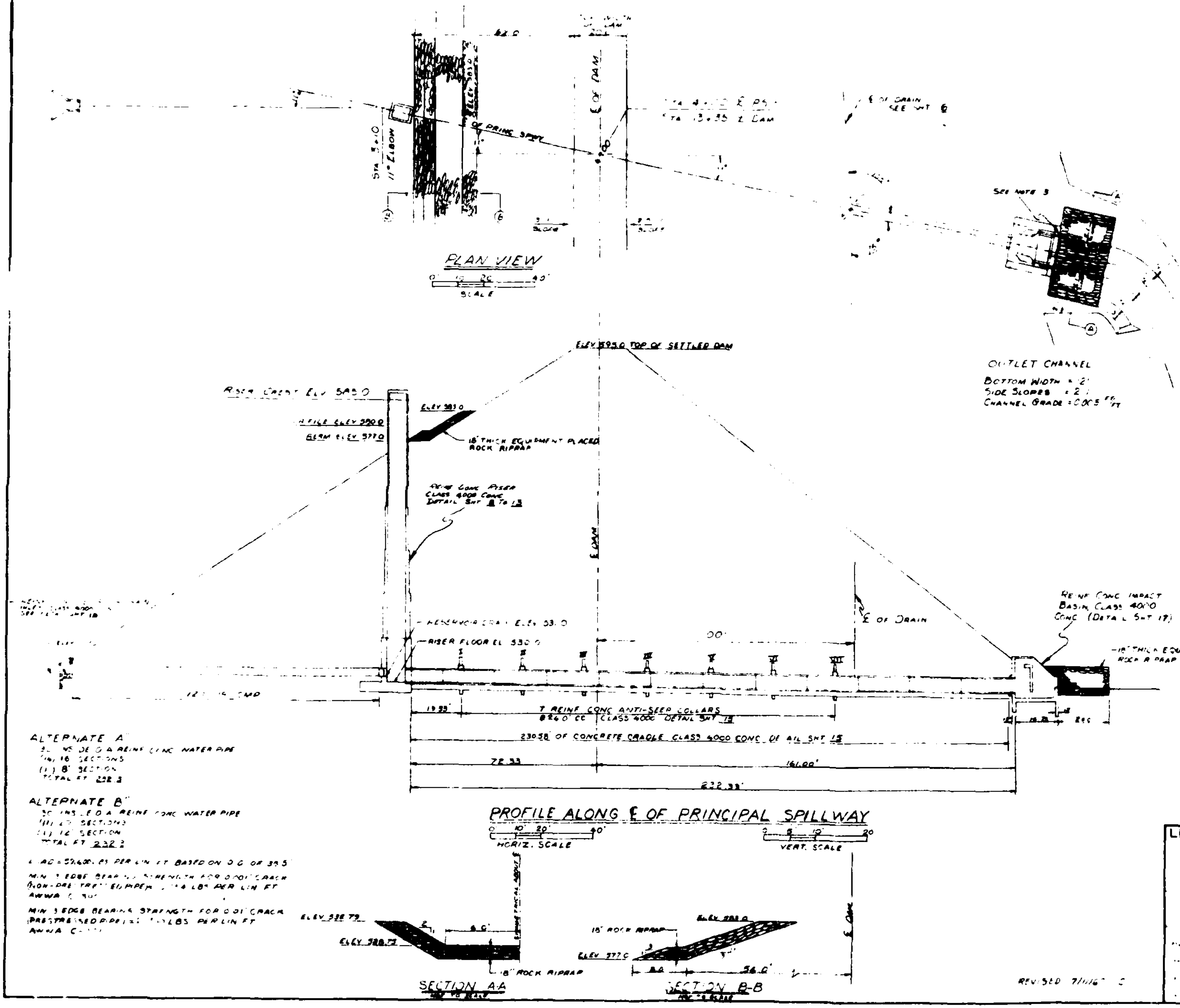
SMALL ANIMAL GUARD DETAILS
NOT TO SCALE
(2 Required)

LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUCTURE DAM NO 3
WEBSTER BROOK SITE
LIMESTONE, MAINE
DRAINAGE DETAILS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	G P BORIE	2-67
Drawn	M ATLAS	2 67
		ME-504-P

REPRODUCED AT GOVERNMENT EXPENSE



ALTERNATE A
30 INS I.D. REINF CONC WATER PIPE
(14) 16' SECTIONS
(1) 8' SECTION
TOTAL FT 232.3

ALTERNATE B
30 INS I.D. REINF CONC WATER PIPE
(11) 20' SECTIONS
(1) 12' SECTION
TOTAL FT 232.3

LOAD = 5,600 LBS PER LIN FT BASED ON D.C. OF 35.5
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK (NON-PRESTRESSED PIPE) = LBS PER LIN FT AWWA C-302
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK (PRESTRESSED PIPE) = LBS PER LIN FT AWWA C-301

ALTERNATE A

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV OF 30" RC PIPE	
	0.33	530.00	0.00
	8.33	529.96	
J-3	24.33	529.88	
J-4	40.33	529.79	
J-5	56.33	529.70	
J-6	72.33	529.62	
J-7	88.33	529.53	
J-8	104.33	529.44	
J-9	120.33	529.35	
J-10	136.33	529.27	
J-11	152.33	529.19	
J-12	168.33	529.10	
J-13	184.33	529.01	
J-14	200.33	528.93	
J-15	216.33	528.84	
OUTLET	232.33	528.75	

ALTERNATE B

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV OF 30" RC PIPE	
J-1	0.33	530.00	0.00
J-2	12.33	529.94	
J-3	32.33	529.83	
J-4	52.33	529.72	
J-5	72.33	529.61	
J-6	92.33	529.51	
J-7	112.33	529.40	
J-8	132.33	529.29	
J-9	152.33	529.18	
J-10	172.33	529.08	
J-11	192.33	528.97	
J-12	212.33	528.86	
OUTLET	232.33	528.75	

NOTE:
DIMENSIONS FOR PIPE LENGTHS ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV OF 30" RC CONDUIT
I	19.33	529.90
II	43.33	529.77
III	67.33	529.64
IV	90.00	529.51
V	115.33	529.38
VI	139.33	529.25
VII	163.33	529.12

NOTE:
1. RESERVOIR DRAIN SHALL CONFORM TO SPEC 3 AND SHALL BE 18" I.C., 16 GUAGE, SHAPE I CLASS I, TYPE D NON-PERFORATED
2. ALL CONCRETE CONDUIT SHALL CONFORM TO MATERIAL SPEC 109
3. DEPRESS RIPRAP AROUND OUTLET DRAIN PIPES

REVISED 7/11/67

LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUCTURE DAM NO 1
WEBSTER BROOK SITE
LIMESTONE, MAINE
PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

G. P. BOWIE	2-67	
M. ATLAS	2-67	
		ME-504-P

REPRODUCED AT GOVERNMENT EXPENSE

TP-1 - Trench along ℄. 16+10 to 16+40

0 - 1.5 Clayey sandy gravel. Topsoil. Roots and organic material. (GC)
At 0.5 - 1.5 Fine silty limestone. St. N.58, dip: near vertical. Thinly irregularly laminated (1/8" sheets). Soft to med. hard (depends on weathering). Weathered slabs can be broken by hand. Breaks into small uneven slabs. Rock surface (weathered) has 1/4" open cracks - depth? Fresh rock is bluish-grey with thin calcite stringers. Rock has a phyllitic sheen, may be due to local intrusive activity. Fresh rock cannot be broken by hand. Weathered zone is at least 1.5' deep if not greater. Laminations are not planar but very irregular. Bedrock surface is irregular in respect to ground surface. Cross sections 1/4 to 1/2" beds of silty limestone, interlayered with 1/8" beds of fissil (paper thin laminations) mudstone. Several horizontal crushed layers (4") were noted. (LS)

TP-2 - ℄ Sta. 16+50, 100' R.

0 - 0.5 Topsoil. (ML)
0.5 - 1.0 Limestone. Same as TP-1. Depth to bedrock 0.5'. (LS)

TP-3 - ℄ Sta. 15+00

0 - 1.5 Silt. Yellowish-brown. Wet. Soft. Low perm. Rapid dil. Very plastic. Floodplain dep. Much organic material including roots. (MH)
1.5 - 2.0 Compressed peat. Very wet. Hole caving. (PT)
2.0 - 7.0 Clayey sandy gravel with sand pockets. Dark yellowish-brown. About 20% fines, 45% f. to c. sand, 35% f. to c. gravel. 5" max. Wet. Hard. Low perm. in GC. No dil. Med plastic. Till. (GC)
At 7.0 Limestone. Vertically bedded limestone. Same as TP-1. (LS)

TP-4 - ℄ Sta. 15+00, 75' upstream

0 - 2.0 Silt. Topsoil. Roots (ML)
2.0 - 2.5 Compressed layer of peat. Water in peat. Hole in this layer. (PT)
2.5 - 5.0 Sandy clay. Bluish-grey. About 50% fines, 40% f. to c. sand, 20% f. to m. gravel. Moist. Hard (PP- 2 T/SF). Low perm. No dil. Mod. plastic. Mod. cohesive. Till. (CL)
5.0 - 11.0 Sandy gravel. About 10% fines, 50% m. to c. sand, 40% f. to c. gravel, 5% cobbles occasional boulders, 1' max. Wet. Loose. Very perm. Rapid dil. Nonplastic. Noncohesive. Outwash. Water filling hole. (GP)

TP-5 - ℄ Sta. 15+00, 200' upstream

0 - 4.0 Gravelly silt. Yellowish-brown. About 50% fines, 20% f. to c. sand, 20% f. to c. gravel. Moist. Soft. Low perm. Slow dil. Med. plastic. Med. cohesive. (ML)
4.0 - 4.5 Compressed peat. (PT)
4.5 - 5.5 Gravelly clay. Dark yellowish brown. About 50% fines, 30% f. to c. sand, 40% f. to c. gravel. 6" max. Moist. Hard. Low perm. No dil. Med. plastic. Mod. cohesive. (GC)
5.5 - 11.0 Silty gravelly sand. Yellowish-brown. About 20% fines, 50% f. to c. sand, 30% f. to c. gravel. Wet. Loose. Very perm. Mod. dil. Nonplastic. Noncohesive. Outwash. Hole filling with water. (SM)

TP-6 - ℄ Sta. 15+00, 120' upstream

0 - 1.0 Silt with gravel. Topsoil. About 30% gravel. (ML)
1.0 Limestone. Vertically bedded, thinly laminated, silty limestone with calcite stringers. At - N.5a. Dip vertical. (LS)

TP-7 - ℄ Sta. 15+50

0 - 2.0 Gravelly silt. Topsoil and slopewash. About 75% fines, 25% sand and gravel. Dry. Soft. Med. perm. (ML)
At 2.0 Limestone. Vertically bedded and thinly bedded fine limestone layered with silty limestone. (LS)

TP-8 - Trench parallel to ℄ and TP-1, 100' upstream

0 - 1.0 Gravelly silt. Topsoil. About 30% coarse fragments. Gravel particles are predominantly weathered bedrock. (ML)
variable 1.0 - 1.5 Limestone. Vertically bedded, thinly (1/8") laminated silty limestone, interlayered with (1/8") thin layers of fissil mudstone. At - N.58. Dip: near vertical. Also some 1/4" layers of fine limestone, dark bluish-grey. Weathering is at least 2' deep, probably greater. Several thin calcite stringers. At about 15+50 upstream, 1/4" open cracks at - upstream-downstream. Dip - 45 E. Weathered and open. Bedrock breaks out predominantly in 2"-5" slivers about 1" wide. (LS)

TP-9 - ℄ Sta. 9+00 to 12+80. Trench

At 9+00
0 - 1.0 Gravelly silt - topsoil. Many roots (ML)
1.0 - 4.5 Clayey sandy gravel. Yellowish-brown. About 20% fines, 40% f. to c. sand, 35% f. to c. gravel, 5% f. to c. cobbles, 5% boulders, 2.0' max. Damp. Hard. (PP - 2.0 to 3.5 T/SF). Low to med. perm. Slightly plastic. Med. cohesive. Till. Coarse particles are a 50-50 mixture of hard resistant rock (igneous) and weathered soft limestone and shale. Sandy pockets in till - also discontinuous layers. (GC) (GM)
At 4.5 variable Limestone. Very weathered and soft. Breaks up easily. St (N.60 E) dip (80 S). Irregular cleavage - open and weathered. Cleavage - vertical - forms blocky chunks. Calcareous layers weathered to clay between more resistant impure layers. Many calcite filled seams. (LS)
At 6.5 Rock less weathered.

TP-10 - ℄ Sta. 7+00

0 - 0.5 Topsoil. Many roots. (ML)
0.5 - 2.0 Gravelly sand. Med. yellowish-brown. About 10% fines, 40% f. to c. sand, 50% f. to c. gravel. Damp. Loose. Very perm. Nonplastic. Slopewash. Flat thirsty particles. (SP)
2.0 - 6.0 Clayey sandy gravel. Dark yellowish brown. About 20% fines, 30% f. to c. sand, 50% f. to c. gravel. Moist. Hard. Low perm. Med. plastic. Med. cohesive. Till. (GC)
At 6.0 Weathered limestone. (LS)

TP-11 - ℄ Sta. 5+00

0 - 0.5 Topsoil. Gravelly silt. (ML)
0.5 - 2.0 Fine sand with chunks of weathered limestone. (SM)
2.0 - 4.5 Clayey sandy gravel. Similar to TP-10. (GC)
At 4.5 Weathered limestone. (LS)

TP-12 -

0 - 0.5 Topsoil. (ML)
0.5 - 5.0 Mixture of silty sand and clayey gravel. Mixture of silt and weathered limestone particles. Variable mixture. (SM-GC)
5.0 Weathered limestone. (LS)

TP-13 -

0 - 0.5 Topsoil. (ML)
0.5 - 5.5 Poorly graded fine sand with chunks of weathered limestone. About 50% fines, 25% gravel, 25% f. to m. cobbles. Terrace material. (SP)
At 5.5 Weathered limestone. (LS)

TP-14 -

0 - 0.5 Topsoil. (ML)
0.5 - 4.0 Sand with chunks of weathered limestone. (SM)
At 4.0 Weathered limestone. (LS)

TP-101 - R. Abutment - Borrow

0 - 1.0 Sandy silt. Yellowish-brown. About 40% f. to m. sand. Dry. Soft. Low perm. No dil. Slightly plastic. Slightly cohesive. Topsoil. (ML)
1.0 - 3.0 Silty gravel. Yellowish-brown. About 60% gravel, 40% fines. Extremely weathered bedrock. (GM)
At 3.0 Limestone. Vertically bedded, thinly laminated limestone. Calcite vein 1/8" wide. N.48 - vertical. (LS)

TP-102 - R. Abutment - Borrow

0 - 1.0 Silt. Topsoil. Many roots (grass) (ML)
1.0 to 3.0 Limestone. Very weathered. Bottom of hole. Weathered limestone probably (LS)

TP-103 - R. Abutment - Borrow

0 - 1.5 Sandy silt. Topsoil. (ML)
1.5 Limestone. Thinly bedded limestone. St (N.60) Dip (vertical). (LS)

TP-104 - R. Abutment - Borrow

0 - 3.0 Clayey sandy gravel. Dark reddish-brown. About 35% fines, 30% f. to c. sand, 35% fine to c. gravel, 6" max. Dry. Hard. Low perm. No dil. Slightly plastic. Till. (GC)
At 3.0 Thinly laminated limestone. Weathered. (LS)

TP-105 - R. Abutment - Borrow

0 - 7.5 Clayey sandy gravel. Dark brown. About 35% fines, 30% f. to c. sand, 35% f. to c. gravel, <1% cobbles, 6" max. Damp. Med. hard. Low perm. No dil. Med. plastic. Slightly cohesive. Till. Coarse particles are predominantly partly weathered limestone - soft and easily broken (GC)
At 7.5 Limestone - thinly laminated, partly weathered (LS)

TP-106 - R. Abutment - Borrow

0 - 6.5 Clayey sandy gravel. Dark brown. About 30% fines, 35% f. to c. sand, 35% f. to c. gravel. 5% cobbles, 6" max. Damp. Hard. Low perm. Med. dil. Med. plastic. Slightly cohesive. Till. (GC)
At 6.5 Limestone, thinly laminated, vert. bedded. (LS)

TP-107 - R. Abutment - Borrow

0 - 1.0 Sandy silt. Topsoil. Grass roots. About 25% f. to c. sand. (ML)
1.0 - 1.5 Silty f. to c. sand. Dk. yellowish-brown. About 20% fines, 75% f. to c. sand. Slopewash. (SM)
1.5 - 3.0 Clayey sandy gravel. Dark yellowish-brown. About 30% fines, 35% f. to c. sand, 35% f. to c. gravel, <1% cobbles, 5" max. Damp. Hard. Low perm. Med. plastic. Med. cohesive. Till. (GC)
At 3.0 Limestone. Thinly laminated. Vertically bedded. Weathered. (LS)

TP-108 - R. Abutment - Borrow

0 - 1.0 Sandy silt. Topsoil. Grass roots (ML)
1.0 - 1.5 Silty sand. (SM)
1.5 - 6.0 Clayey sandy gravel. About 25% fines, 35% f. to c. sand, 40% f. to m. gravel. Damp. Soft. Low to med. perm. Med plastic. Slightly cohesive. Till. Particles predominantly weathered limestone (can be broken by hand). (GC)
At 6.0 Limestone - weathered (LS)

TP-109 - R. Abutment - Borrow

0 - 1.0 Sandy silt. Topsoil. Many roots (ML)
1.0 - 2.5 Clayey sandy gravel. Yellowish brown. About 30% fines, 25% f. to c. sand, 45% f. to c. gravel, 5" max. Damp. Soft. Low perm. Med. plastic. Slightly cohesive. Till. (GC)
At 2.5 Limestone - weathered. (LS)

TP-110 - R. Abutment - Borrow

0 - 1.0 Gravelly silt - topsoil. Many grass roots. (ML)
1.0 - 8.0 Sandy gravel. Med. yellowish-brown. About 10% fines, 30% f. to c. sand, 40% f. to c. gravel, 5% cobbles, 5% boulders, 2.0' max. Moist below 4'. Loose. Very perm. Nonplastic. Noncohesive. Poor stratification. Gully wash. (GW)
At 8.0 Limestone - weathered (LS)

TP-111 - R. Abutment - Borrow

0 - 1.0 Gravelly silt. Topsoil. Grass roots. (ML)
1.0 - 2.0 Clayey gravel. Yellowish brown. About 30% fines, 15% f. to c. sand, 45% f. to c. gravel. Damp. Loose. Very perm. Slightly plastic. Slightly cohesive. Washed till. (GC)
At 2.0 Limestone. Very weathered limestone 2 - 4'. Fresh at 4'. (LS)

TP-112 - R. Abutment - Borrow

0 - 0.5 Gravelly silt. Topsoil. (ML)
0.5 - 2.0 Clayey sand. Yellowish-brown. About 30% fines, 50% f. to c. sand, 10% c. gravel. Dry. Loose. Very perm. Slightly plastic. Coarse particles are predominantly weathered limestone. (SC)
At 2.0 Limestone. Weathered (LS)

TP-113 - R. Abutment - Borrow

0 - 2.0 Gravelly silt. About 50% fines, 25% f. to c. sand, 25% f. to c. gravel. Damp. Soft. Slightly plastic. Topsoil. Some roots. (ML)
At 2.0 Limestone. Very weathered (LS)

TP-114 - R. Abutment - Borrow

0 - 1.0 Gravelly silt. Topsoil (ML)
At 1.0 Limestone. (LS)

TP-115 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 1.5 Clayey sandy gravel. Compacts well. (GC)
At 1.5 Very weathered limestone. Hole taken to 4' - fresher limestone. (LS)

TP-116 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 2.0 Clayey sandy gravel (good core material) (GC)
2.0 - 8.0 Fine sand with chunks of weathered limestone. About 50% sand, 50% gravel. (SP)
At 8.0 Weathered limestone. (LS)

TP-117 - R. Abutment - Borrow

0 - 1.0 Topsoil and gravelly clay. (CL)
1.0 - 4.0 Sand with weathered limestone and igneous rock fragments. (SP)
4.0 - 7.0 Clayey sand with limestone and igneous rock fragments. (SC)
At 7.0 Weathered limestone. (LS)

TP-118 - R. Abutment - Borrow

0 - 1.0 Clayey sand and topsoil. (SC)
1.0 - 6.0 Sand with weathered limestone particles. (SP)
At 6.0 Weathered limestone. (LS)

TP-119 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 3.5 Gravelly silty sand. About 20% fines, 50% f. to c. sand, 30% f. to m. gravel. Particles are mostly weathered limestone. (SM)
At 3.5 Weathered limestone. (LS)

TP-120 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 5.0 Gravelly sand. About 40% sand, 40% f. to c. gravel. Mostly weathered limestone. Loose. Very perm. Nonplastic. (SP)
At 5.0 Weathered limestone. (LS)

TP-121 - R. Abutment - Borrow

0 - 1.0 Topsoil. (ML)
1.0 - 4.5 Gravelly sand. About 40% m. sand, 40% f. to c. gravel. Limestone and igneous rock 50/50. (SP)
4.5 Weathered limestone. (LS)

TP-122 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 5.0 Silty sandy gravel. About 20% fines, 30% sand, 50% gravel. (GM)
5.0 - 9.0 Sandy gravel - water entering at 5' filling (GP)

TP-123 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 4.5 Silty sandy gravel. About 30% fines, 30% sand, 40% gravel. Damp. Soft. Med perm. Slightly plastic. (GM)
At 4.5 Weathered limestone. (LS)

TP-124 - R. Abutment - Borrow

0 - 0.5 Topsoil. (ML)
0.5 - 5.5 Sandy silty gravel. About 10% fines, 30% sand, 50% gravel. Limestone and hard rock fragments. (GM)
At 5.5 Weathered limestone. (LS)

TP-125 - R. Abutment - Borrow

0 - 1.0 Gravelly silt with grass roots. (ML)
1.0 - 2.5 Clayey sandy gravel. About 30% fines, 35% sand, 35% gravel. (GC)
2.5 - 8.5 Sandy gravel. About 10% fines, 40% sand, 50% f. to c. gravel - alluvium. (GP)
At 8.5 Weathered limestone. (LS)

TP-126 - R. Abutment - Borrow

0 - 1.0 Gravelly silt - topsoil. (ML)
1.0 - 7.5 Sandy gravel. About 15% fines, 40% f. to c. gravel. Fine alluvium. (1-1.5' has about 25% fines.) (GP)
7.5 Weathered limestone. (LS)

TP-127 - R. Abutment - Borrow

0 - 1.0 Gravelly silt. (ML)
1.0 - 4.0 Gravelly silty sand. About 25% fines, 55% f. to c. sand, 20% f. to c. gravel. (SM)
At 4.0 Limestone. (LS)

TP-128 - R. Abutment - Borrow

0 - 1.0 Gravelly silt with grass roots. (ML)
1.0 - 5.0 Gravelly silty sand. About 30% fines, 50% f. to c. sand, 20% f. to c. gravel. Damp. Soft. Med. perm. Slightly plastic (core). (SM)
5.0 - 10.0 Clayey sandy gravel. Dk. grey. About 30% fines, 30% f. to c. sand, 35% f. to c. gravel, 5% cobbles. Damp. Hard. Low perm. Med. plastic. Med. cohesive. (GC)
10.0 - 11.0 Sandy gravel. Water bearing - slow flow (GP)

TP-129 - R. Abutment - Borrow

0 - 1.0 Gravelly silt. (ML)
1.0 - 6.0 Clayey sandy gravel. About 40% fines, 30% sand, 30% f. to c. gravel. Damp. Soft. Med. perm. Med. plastic. (GC)
At 6.0 Limestone. (LS)

TP-130 - R. Abutment - Borrow

0 - 1.0 Topsoil. (ML)
1.0 - 3.0 Silty sandy gravel. (GM)
3.0 - 7.0 Clayey sandy gravel. About 25% fines, 30% f. to c. sand, 45% f. to c. gravel. Damp. Hard. Low perm. Med. plastic. Till. (GC)
At 7.0 Limestone. (LS)

TP-131 - R. Abutment - Borrow

0 - 1.0 Topsoil. (ML)
1.0 - 11.0 Gravelly clayey sand grading to a clayey sandy gravel. About 40% fines, 30% gravel, about 30% f. to c. cobbles. Damp. Hard. Low perm. Med. plastic. Med. cohesive. Till. No rock encountered. (GC-SC)

Note:
1. For Legend & Notes See Sheet No 20 of 21, ME-504-P

LIMESTONE STREAM WATERSHED PROJ.
MULTI-PURPOSE STRUCTURE DAM NO 3
WEBSTER BROOK SITE
LIMESTONE, MAINE
TEST PITS LOGS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TYPED BY L R BERRY 3-67
Sheet 19 of 21 ME-504-P

REPRODUCED AT GOVERNMENT EXPENSE

TP-132 - R. Berm [illegible] - Borrow

Ground waterable at surface.

TP-133 - R. Abutment - Borrow

0 - 1.0	Silt. Gravelly (20%). Much organic matter.	(ML)
1.0 - 3.5	Sandy silt. Fine sand, about 30%. Rocks small.	(ML) (ML)
3.5 - 6.0	Very large cobbles and boulders with sand matrix.	(GP)

TP-134 - R. Abutment - Borrow

0 - 2.0	Sandy gravel.	(SP)
At 2.0	Limestone.	(LS)

TP-135 to TP-137 - R. Abutment - Borrow

Shallow to rock, less than 3' of soil.

TP-138 - R. Abutment - Borrow

0 - 1.0	Gravelly silt.	(ML)
1.0 - 8.0	Clayey sandy gravel. About equal percentages of fines, sand and gravel, 5% cobbles and boulders, 1' max. Damp. Hard. Low perm. No dil. Med. plastic. Very cohesive. Till. Good borrow. Sandy pockets (1,2'). Sample 138.1 GC. No bedrock at 8'.	(GC) (GC-GP)

TP-139 - R. Abutment - Borrow

0 - 1.0	Top soil.	(ML)
1.0 - 4.0	Clayey sandy gravel. Med. yellowish-brown. About 40% fines, 10% f. to c. sand, 45% f. to c. gravel, 5% cobbles, 6" max. Damp. Hard. Low perm. Med. plastic. Very cohesive. Till. (Good borrow).	(GC)
At 4.0	Limestone. weathered	(LS)

TP-140 - R. Abutment - Borrow

0 - 2.0	Silt.	(ML)
2.0 - 4.5	Silty sand. Water at 4.5'.	(SM)

TP-141 - R. Abutment - Borrow

0 - 2.0	Silty sandy gravel or gravelly silty sand.	(GM-SP)

TP-142 - R. Abutment - Borrow

0 - 5.0	Silty gravelly sand or sandy gravel. Wet below 2'.	(SM)

TP-143 - L. Abutment - Borrow

0 - 2.0	Organic silt.	(ML)
2.0 - 5.5	Clayey sandy gravel. About 40% fines, 20% sand, 40% gravel. Damp. Hard. Low perm. Med. plastic. Med. cohesive. Till.	(GC)
At 6.5	Weathered limestone.	(LS)

TP-144 - L. Abutment - Borrow

0 - 2.0	Clayey gravel.	(GC)
2.0 - 7.0	Sandy gravel	(GC)
At 7.0	Limestone.	(LS)

TP-145 - L. Abutment - Borrow

0 - 1.0	Topsoil.	(ML)
1.0 - 5.0	Clayey sandy gravel. Till.	(GC)

TP-146 - L. Abutment - Borrow

0 - 1.0	Topsoil.	(ML)
1.0 - 4.5	Clayey sandy gravel. Water at 4.5'.	(GC) (GC)

TP-147 - R. Abutment - Borrow

0 - 1.0	Topsoil.	(ML)
1.0 - 2.5	Clayey sandy gravel.	(GC)
At 2.5	Limestone.	(LS)

TP-201 - ℄ Sta. 5+75

0 - 0.5	Topsoil. Gravelly silt.	(ML)
0.5 - 5.0	Sandy silty gravel. Med. yellowish-brown. About 20% fines, 30% f. to c. sand, 50% f. to c. gravel. Particles are mixture of weathered limestone and hard durable rock. Damp. Loose. Very perm. Nonplastic. Noncohesive. Slopes much.	(GM-SM)
5.0 - 6.0	Very weathered limestone. Can be broken by hand, less weathered at 1.5'.	(LS)

TP-202 - 100' S of TP 201

0 - 0.5	Gravelly silt.	(ML)
0.5 - 4.0	Silty fine sand with gravel size chunks of weathered limestone. About 29% fines, 40% f. to c. sand, 35% m. to c. gravel, 5% cobbles. Moist. Loose. Very perm. Nonplastic. Noncohesive. Weathered limestone is extremely soft.	(SM)
At 4.0	Weathered limestone.	(LS)

TP-203 - 100' E of TP-202

0 - 0.5	Topsoil. Many roots.	(ML)
0.5 - 2.5	Silty fine sand with chunks of weathered limestone. About 25% fines, 40% f. to c. sand, 30% f. to c. gravel, 5% cobbles. Mostly weathered limestone - broken by hand - some hard gravel. Damp. Soft and loose. Very perm. Nonplastic. Noncohesive. Terrace Dep. Sand has been water deposited.	(SM)

TP-204

0 - 0.5	Topsoil. Gravelly silt.	(ML)
0.5 - 2.0	Silty sand gravel. Yellowish-brown. About 25% fines, 30% f. to c. sand, 45% f. to c. gravel. Particles are 60% hard and resistant rock. Damp. Loose. Med. perm. Slightly plastic. Slightly cohesive. Till.	(GM)
2.0 - 5.0	Extremely weathered limestone.	(LS)

TP-205

0 - 0.5	Topsoil.	(ML)
0.5 - 5.5	Sandy silty gravel. Yellowish-brown. About 20% fines, 30% f. to c. sand, 45% f. to c. gravel, 5% cobbles. Particles are mostly hard and durable. Damp. Hard. Med. perm. Slightly plastic and cohesive. Till.	(GM)
At 5.5	Weathered limestone.	(LS)

TP-206

0 - 0.5	Topsoil.	(ML)
0.5 - 6.5	Silty sand with gravel and cobbles of weathered limestone and hard durable rock. About 20% fines, 40% f. to c. sand, 40% f. to c. gravel and cobbles.	(SM-GM) (GM)
At 6.5	Weathered limestone.	(LS)

TP-207

0 - 0.5	Topsoil.	(ML)
0.5 - 3.5	Silty gravelly sand. About 20% fines, 50% f. to c. sand, 30% f. to c. gravel, small percentage of cobbles. Particles are a mixture of weathered limestone and hard rock. Damp. Soft. Very perm. Nonplastic.	(SM)
3.5 - 8.0	Clayey sandy gravel. Grayish-brown. About 40% fines, 30% f. to c. sand, 45% f. to c. gravel, 5% f. cobbles. Damp. Hard. Low perm. Med. plastic. Med. cohesive. Till. Good borrow.	(GC)
At 8.0	Limestone.	(LS)

TP-208

0 - 0.5	Topsoil.	(ML)
0.5 - 4.5	Sandy clayey gravel. About 25% fines, 30% f. to c. sand, 35% f. to c. gravel, 10% cobbles. Particles are mostly hard and durable. Damp. Hard. Med. perm. Med. plastic. Med. cohesive. Till. 0.5' of sand over bedrock.	(GC)
At 5.0	Weathered limestone.	(LS)

TP-209 Em. Spwy ℄ Sta. 4+00

0 - 1.0	Topsoil, gravelly.	(ML)
At 1.0	Weathered limestone.	(LS)

TP-210 - Em Splwy ℄ Sta. 5+00

0 - 0.5	Topsoil.	(ML)
0.5 - 7.0	Silty gravelly sand. Yellowish-brown. About 35% fines, 35% f. to c. sand, 25% f. to c. gravel, 5% cobbles. Damp. Loose. Very perm. Slightly plastic. Noncohesive. Till.	(SM)
At 7.0	Weathered limestone.	(LS)

TP-211 Em. Splwy ℄ Sta. 6+00

0 - 1.0	Topsoil, gravelly silt.	(ML)
1.0 - 6.0	Gravelly sand. Yellowish-brown. About 15% fines, 50% f. to c. sand, 35% f. to c. gravel. Damp. Loose. Very perm. Nonplastic and noncohesive. At and below 4', gravel particles are predominantly weathered limestone.	(SP-SM)
At 6.0	Weathered limestone.	(LS)

TP-212 - 100' NW of ES ℄ Sta. 7+00

0 - 1.0	Topsoil. Gravelly silt.	(ML)
1.0 - 6.5	Sandy gravel. About 50% poorly graded sand. Gravel chunks of weathered limestone and hard cobbles (50% gravel and f. cobbles). Damp. Loose. Very perm. Nonplastic. Noncohesive. Three 1.5' boulders - rounded.	(SP)
At 6.5	Weathered limestone.	(LS)

TP-213 - 100' NW of ES ℄ Sta. 6+00

0 - 0.5	Topsoil.	(ML)
0.5 - 4.0	Silty gravelly sand. About 25% fines, 50% f. to c. sand, 25% f. to m. gravel. Moist. Soft. Med. perm. Slightly plastic. Slightly cohesive. Particles are predominantly weathered limestone.	(SM)
4.0 - 5.0	Very weathered limestone.	(LS)

TP-214 - 100' NW of ES ℄ Sta. 5+00

0 - 0.5	Topsoil.	(ML)
0.5 - 3.0	Silty sand. About 35% fines, 40% f. to c. sand, 25% f. gravel. Damp. Soft. Very perm. Med. plastic. Slightly cohesive.	(SM)
At 3.0	Weathered limestone - hard.	(LS)

TP-215 - 100' E of ES ℄ Sta. 6+00

0 - 0.5	Topsoil.	(ML)
0.5 - 3.0	Clayey gravelly sand. About 40% fines, 50% f. to c. sand, 30% f. to c. gravel. Damp. Soft. Low perm. Med. plastic. Med. cohesive.	(SC)
3.0	Limestone.	(LS)

TP-216 - ES ℄ Sta. 10+00

0 - 0.5	Topsoil, gravelly silt.	(ML)
0.5 - 9.0	Variable mixture of silt, sand, gravel and cobbles. Some 2' boulders. Damp. Loose. Very perm. Nonplastic. Noncohesive. Side hill terrace.	(GM-SP)
At 9.0	Limestone.	(LS)

TP-501 - Trench 75' downstream, parallel to trench of TP-1

0 - 2.0	Topsoil - with rocks. Gravel particles are 60% weathered pieces of limestone. Many roots.	(GC)
1.5 - 2.0	Limestone. Same as TP-1. At about 17/75, 3" wide vertical crevices noted - filled with weathered calcite. Parallel to strike, rock can be ripped easily.	(LS)

TP-502 - ℄ Sta. 15/50, 100' downstream

0 - 3.0	Gravelly silt. Yellowish-brown. About 10% f. to c. gravel - rotten limestone. Dry. Soft. Low. perm. Med. plastic. Slightly cohesive. Slopewash.	(ML)
At 3.0	Limestone. Same as TP-1. Vertically bedded, thinly laminated silty limestone, interlayered with very thin laminations of mudstone.	(LS)

TP-503 - ℄ Sta. 15/00, 100' downstream

0 - 3.0	Silt. Yellowish-brown. About 80% fines, 10% f. to c. sand, 10% f. to c. gravel. Wet. Soft. Low perm. Rapid Dilatancy. Very plastic. Med. cohesive. Floodplain deposits. Much organic matter in silt. Water on surface.	(ML)
3.0 - 9.5	Poorly graded gravel. About 10% fines, 10% f. to c. sand, 70% m. to c. gravel. Wet. Loose. High perm. No dilatancy. Nonplastic. Noncohesive. Hole caving. Water flowing through gravel. At bottom of hole a few fragments of a very cohesive GC were retrieved. There may be a layer at this level.	(GP)

TP-504 - ℄ Sta. 12/70, 100' downstream

0 - 0.5	Topsoil.	(ML)
At 0.5	Limestone. Weathered	(LS)

TP-505 - ℄ Sta. 11/75, 100' downstream

0 - 0.5	Topsoil, many, many roots.	(ML)
0.5 - 1.5	Sandy clayey gravel. Med. yellowish-brown. About 30% fines, 20% f. to c. sand, 50% f. to c. gravel. Mostly weathered limestone fragments. Moist. Loose. Very perm. Slightly plastic. Slightly cohesive.	(GC)
At 1.5	Limestone - very weathered	(LS)

TP-506 - ℄ Sta. 8/00, 100' downstream

0 - 0.5	Topsoil - ML with many rocks.	(ML)
0.5 - 5.0	Poorly graded fine sand with gravel and cobble size particles of weathered limestone. About 50% sand and 50% gravel and cobbles. Chunks easily broken by hand. Soft. Loose. Moist. Very perm. Nonplastic. Noncohesive. Terrace outwash.	(SP)
At 5.0	Limestone - weathered	

TP-507 - ℄ Sta. 9/50, 100' downstream

0 - 0.5	Topsoil. ML with many rocks	(ML)
0.5 - 5.5	Poorly graded fine sand with weathered chunks of rock. About 50% fine sand, 50% gravel and cobbles. Damp. Loose. Very perm. Nonplastic. Noncohesive. Terrace dep.	(SP)
At 5.5	Limestone - weathered	

TP-508 - ℄ Sta. 8/40, 100' downstream

0 - 1.0	Gravelly silt. ML topsoil.	(ML)
1.0 - 3.0	Silty clayey gravel.	(GM)
3.0 - 4.0	Extremely weathered limestone. Crumbles to sand and fines when in hand.	(LS)
At 4.0	More resistant limestone - weathered	

TP-509 - ℄ Sta. 7/00, 75' downstream

0 - 0.5	Topsoil.	(ML)
0.5 - 3.0	Fine sand with chunks of weathered limestone. Damp. Loose. Very perm. Nonplastic. Noncohesive.	(SP)
3.0 - 5.0	Clayey sandy gravel. Dark yellowish-brown. About 30% fines, 20% f. to c. sand, 35% f. to c. gravel. Damp. Hard. Low perm. Med. plastic. Med. cohesive.	(GC)
5.0 - 7.0	Weathered limestone.	(LS)

LEGEND

DH-1	Drill hole (1½" I.D.)
TP-1	Test Pit (backhoe)
GWT	Ground water table.
10YR 5/4	Refers to Munsell Book & Soil Color coding system.
PP	Pocket Penetrometer, (Tons/ft²)
NX	2 1/8" Rock core from series M core barrel.
k	Permeability rate.
N	Blows/ft, 2" O.D. Split tube sampler, 140# hammer, 30" drop.
u.s. or d.s.	Upstream or downstream.
E.S.	Emergency Spillway.
R-2-B	Core run with BX core barrel.

TEST HOLE NUMBERING SYSTEM

Centerline of dam	1-99
Borrow Area	101-199
Emergency Spillway	201-299
Centerline of outlet structure	301-399
Stream Channel	401-499
Relief wells	501-599
	601-699
	701-799

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW	Well graded gravels; gravel-sand mixtures
GP	Poorly graded gravels
GM	Silty gravels; gravel-sand-silt mixtures
GC	Clayey gravels; gravel-sand-clay mixtures
SW	Well graded sands; sand-gravel mixtures
SP	Poorly graded sands
SM	Silty sands; sand-silt mixtures
SC	Clayey sands; sand-clay mixtures
ML	Silts; silty, v. fine sands; sandy or clayey silts
CL	Clays of low to medium plasticity; silty, sandy or gravelly clays
CH	Clays of high plasticity; fat clays
MH	Elastic silts; micaceous or diatomaceous silts
OL	Organic silts and organic silty clays of low plasticity
OH	Organic clays or silts of medium to high plasticity

BEDROCK SYMBOLS

B	Basalt	Sc	Schist
Gn	Gneiss	Sh	Shale
Gr	Granite	Si	Siltstone
Ls	Limestone	Sl	Slate
M	Marble	Ss	Sandstone

SAMPLES

DS	Disturbed
UD	Undisturbed

Note: All descriptions and classifications based on visual observations and the Unified Soil Classification System.

All test pits and drill holes are located on plans and profiles for the site.

Test pitting accomplished from 9/27/65 to 10/4/65. Drilling accomplished from 11/8/65 to 1/20/66. All test holes logged by D. Grimshaw, Geologist.

All drill holes were cased with 3.5" NX casing in overburden. The rock was cored with an NX series M core barrel. All test pits were dug with a hydraulic backhoe mounted on a Case 310 crawler.

(GC) Visual Classification

(GC) Lab Classification

Note: Test Pits 135 to 137 shallow to rock (less than 3 feet)

LIMESTONE STREAM WATERSHED PROJ.
MULTI-PURPOSE STRUCTURE DAM NO. 3
WEBSTER BROOK SITE
LIMESTONE, MAINE
TEST PITS LOGS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TYPED BY L R GERRY 3-67
20 / 21
ME-504-P

REPRODUCED AT GOVERNMENT EXPENSE

[illegible]

At [illegible] Bedrock (Limestone)
Thinly bedded silty limestone.
B-1 [illegible], [illegible]% rec.
B-2 [illegible].5'-2[illegible].5', 95% rec.
B-3 2[illegible].5'-2[illegible].5', 100% rec.
Constant head test at [illegible] K=2.[illegible] ft/day.
No pressure loss in all pressure holding tests in bedrock.
The rock core is only severly fractured in the upper 2'.

DH-[illegible] ℄ Principal Spillway Station [illegible]+35 Elev. [illegible].5'.

0	2.0	Cobbles and boulders - fieldstone	
2.0	[illegible].0	Gravelly sandy silt. Olive grey. About 50% fines, 25% f. to c. sand, 25% f. to m. gravel. Wet. Soft. Moderate permeability. Rapid dilatency. Slightly plastic. Slightly cohesive.	(ML)

5.0'-5.5', B 16
5.5'-6.0', B [illegible]
6.0'-[illegible].5', B 18
Ground water table at 1.0'.
Constant head test at 5.0' and [illegible] failed due to water leaking around casing.

At [illegible] Bedrock. (Limestone)
Bluish-grey thinly laminated silty limestone. Bedding is near vertical. Many calcite veins. Top [illegible]' of rock is extremely fractured and contains dark organic matter.
B-1 [illegible]'-11', 95% rec.
B-2 11'-1[illegible]', 105% rec.
B-[illegible] [illegible]'-1[illegible]', 48% rec.
B-[illegible] [illegible]'-[illegible]', 95% rec.
Pressure flow test 1[illegible].5' to 1[illegible].5' K=.[illegible] ft/day.
Pressure holding test, no loss below 15'.

DH-5 ℄ Sta. [illegible] Elev. [illegible]5.5

0 - [illegible].0 Topsoil. (ML)
At [illegible] Bedrock. (Limestone)
Thinly bedded silty limestone. Beds are extremely crenulated. Many calcite veins. The rock is generally very fractured.
B-1 [illegible]'-5.0', [illegible]% rec.
B-2 5.0'-[illegible]', 50% rec.
B-3 [illegible]'-1[illegible]', 75% rec.
B-4 1[illegible]'-18.[illegible]', 97% rec.
B-5 18.[illegible]'-2[illegible]', 90% rec.
B-6 2[illegible]'-2[illegible]', 98% rec.
B-7 2[illegible]'-2[illegible]', 93% rec.
B-8 2[illegible]'-[illegible]', 60% rec.
Ground water table at [illegible].
Two severe fracture zones are located from [illegible]' to [illegible].0' and 21.0' to 28.0'.
Pressure holding test, instant loss, [illegible].0'-[illegible].0'. Water leaking around packers.
Pressure flow test [illegible], K=.1[illegible] ft/day.
Pressure flow test [illegible], K=.1[illegible] ft/day.
Pressure flow test 19-[illegible], K=.2[illegible] ft/day.
Pressure flow test 25-[illegible], K=.15 ft/day.
Pressure flow test [illegible], K=[illegible] ft/day
Pressure holding test, [illegible]'-19.[illegible]', no loss.
Many fractures filled with fines. [illegible]" void at [illegible].

DH-[illegible] ℄ Sta. [illegible] Elev. [illegible]

0 - [illegible] Clayey gravel mixed with layers of clean sand. (GC-SW)
Constant head test at [illegible], K [illegible] ft/day.
At [illegible] Bedrock. (Limestone)
Bluish grey, silty limestone. Crenulated bedding. Many fractures. The rock is hard and brittle. Many calcite seams and pockets.
B-1 5.0'-[illegible]', 75% rec.
B-2 [illegible]'-12.0', [illegible] rec.
B-3 12.0'-17.[illegible]', [illegible] rec.
B-4 17.0'-22.0', 18% rec.
B-5 22.0'-2[illegible]', 70% rec.
B-6 2[illegible].7'-28.0', 136% rec.
B-7 28.0'-3[illegible]', [illegible] rec.
B-8 [illegible]'-32.0', [illegible] rec.
B-9 [illegible]'-[illegible]7.0', 96% rec.
B-10 37.0'-42.0', 115% rec.
B-11 42.0'-[illegible]', 77% rec.
B-12 [illegible]'-50.0', 11[illegible]% rec.
Frequent core blocking.
Ground water table at 19.5'.
Silt filled seams at [illegible], [illegible], and [illegible].
Pressure holding test 0'-11', no pressure loss.
Pressure flow test 11'-50', K=.1 ft/day.
Pressure flow test 16'-50', K=.[illegible]2 ft/day.
Pressure holding test 11'-16', no pressure loss.

DH-7 ℄ Sta. 15+00 Elev. [illegible]

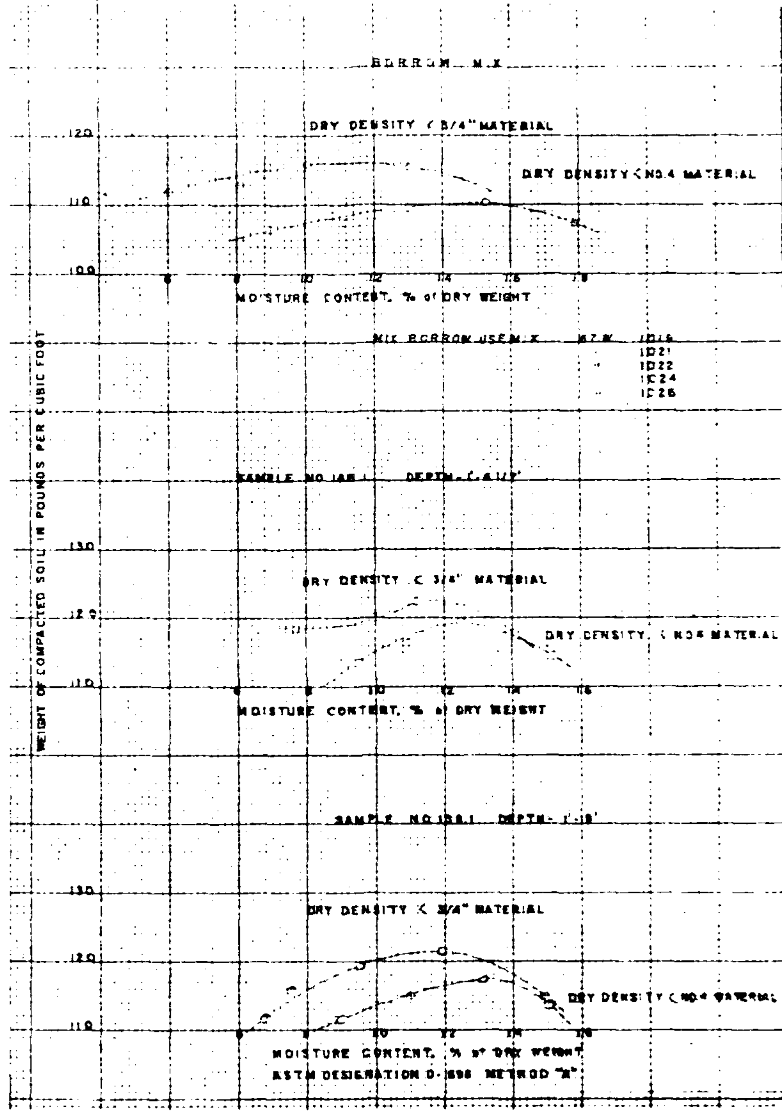
0 - [illegible].0 Silty gravelly sand. (SM)
At [illegible] Bedrock. (Limestone)
Thinly bedded silty limestone. Vertically inclined beds. Many calcite-filled seams. Severe fracturing in top 8' of core.
B-1 [illegible]'-6.2', [illegible] rec.
B-2 [illegible].2'-10.0', 80% rec.
B-3 10.0'-1[illegible].5', 107% rec.
B-[illegible] 1[illegible]'-1[illegible].5', 105% rec.
Ground water table at 2.[illegible]'.
Pressure holding test 5'-10', no pressure loss.
Pressure holding test 10'-1[illegible]', no pressure loss.
Small fault noted in B-3. Movement is not recent.

DH-8 ℄ Spw. 16+[illegible] Elev. 5[illegible].5

0 - 1.[illegible] Topsoil. (ML)
At 1.[illegible] Bedrock. (Limestone)
Thinly bedded, severly fractured silty limestone. Many calcite filled seams. Rock is hard and brittle. Bedding is near vertical.
B-1 1.[illegible]-3.[illegible]', 35% rec.
B-2 [illegible]'-[illegible].2', [illegible]% rec.
B-3 [illegible].2'-[illegible].9', 100% rec.
B-4 [illegible].9'-9.1', 95% rec.
B-5 9.1'-1[illegible].0', 105% rec.
B-6 1[illegible]'-19.0', 10[illegible]% rec.
B-7 19.0'-24.0', 97% rec.
B-8 24.0'-29.[illegible]', 10[illegible]% rec.
B-9 29.0'-[illegible].0', 10[illegible]% rec.
Frequent core blocking. Rebound water table at 7.2'.
Pressure holding test 5'-10', no pressure loss.
Pressure holding test 10'-[illegible]', no pressure loss.
Top [illegible]' of bedrock is too fractured to set packers for pressure test.
Small fault in B-8

DH-9 ℄ Sta. 17+00 Elev. 5[illegible]

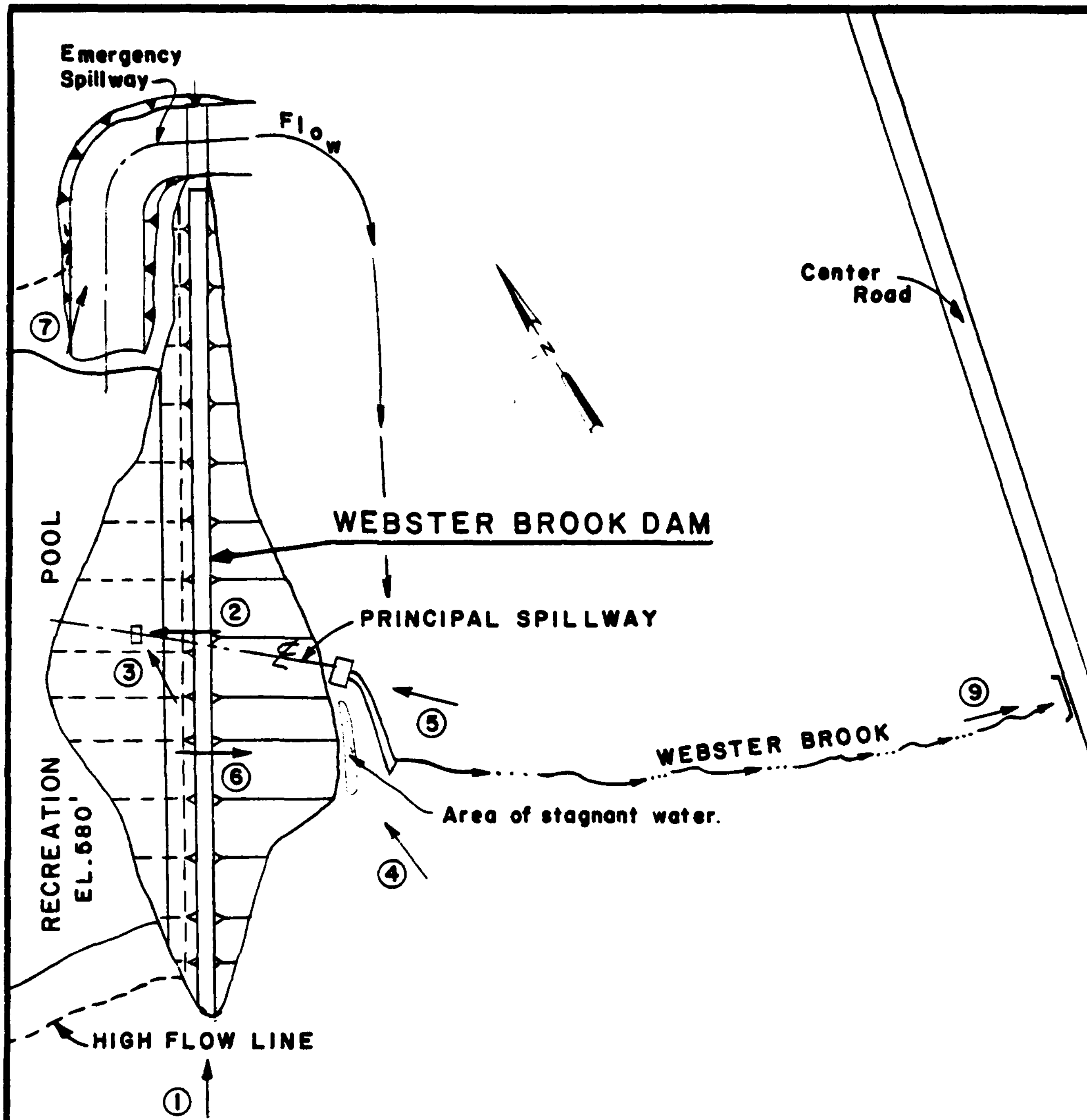
0 - 2.1 Topsoil. (ML)
At 2.1 Bedrock. (Limestone)
Bluish-grey silty limestone. Many calcite-filled fractures. Fresh rock is hard and brittle. Beds are near vertical.
B-1 2.1'-[illegible].2' 29% rec.
B-2 [illegible].1'-9.1' [illegible]% rec.
B-3 9.1'-12.[illegible]' 95% rec.
B-4 12.5'-1[illegible]' 55% rec.
B-5 1[illegible]'-17.6' 139% rec.
B-6 17.6'-18.0' 0% rec.
B-7 18.0'-21.0' 66% rec.
B-8 21.0'-2[illegible].0' 56% rec.
B-9 22.6'-2[illegible].0' 92% rec.
B-10 2[illegible].0'-[illegible].0' 90% rec.
B-11 [illegible].0'-[illegible].8' 85% rec.
B-12 [illegible]'-35.0' 95% rec.
B-13 35.0'-[illegible].0' [illegible]% rec.
B-1[illegible] [illegible].0'-[illegible].5' 72% rec.
B-1[illegible] [illegible]'-[illegible]6.0' 0% rec.
B-16 [illegible].0'-[illegible]7.6' 100% rec.
B-17 [illegible]7.6'-50.0' 105% rec.
B-18 50.0'-[illegible] 102% rec.
Upper 20' of rock is badly fractured.
All drill water was lost in top 1[illegible]'.
Ground water table at [illegible].
Frequent core blocking.
The rock is hard and brittle.
Could not pressure test top 10' of rock due to fractured condition.
Pressure holding test 1.5-52.0, no pressure loss.
Pressure flow test [illegible].5'-1[illegible].5', K=.[illegible]1 ft/day.
Pressure holding test [illegible], no pressure loss.
Pressure holding test 2[illegible], no pressure loss.



LIMESTONE STREAM WATERSHED PROJ
MULTI-PURPOSE STRUCTURE DAM NO. 3
WEBSTER BROOK SITE
LIMESTONE, MAINE
LOGS OF DRILL HOLES
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
INVEST. BY D.C. ERMAKES
TYPED BY [illegible] 3-67
ME-504-P

APPENDIX C

PHOTOGRAPHS



LEGEND

1 PHOTO LOCATION

NOTE: Photo No. 8 is not shown on this map.

WEBSTER BROOK DAM PHOTO LOCATION

U.S. ARMY CORPS OF ENGINEERS
PHASE I INSPECTION PROGRAM

MAIN

DATE November, 1980		
CLIENT	JOB	PLATE
1345	72	4

REPRODUCED AT GOVERNMENT EXPENSE

Photo #1

General view of Dam from right Abutment

Photo #2

View of Principal Spillway Intake from Crest of Dam.

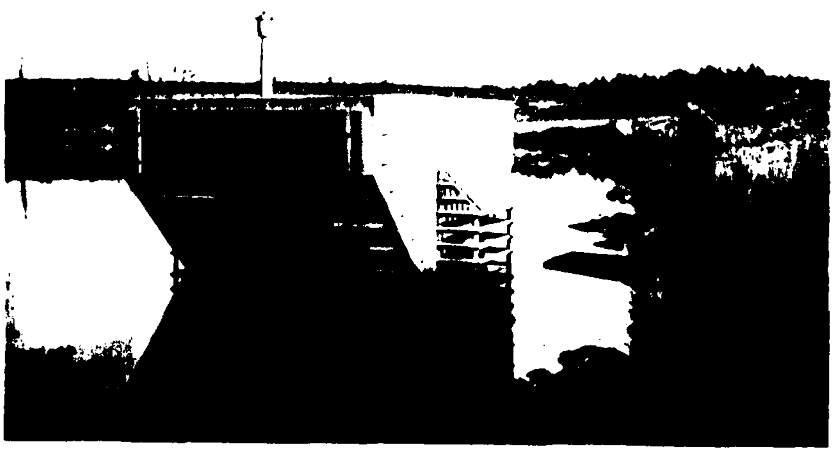


Photo #3

Close-up View of Principal Spillway Intake Structure

REPRODUCED AT GOVERNMENT EXPENSE

Photo #4
View of Downstream
Slope with Outlet
Structure

Photo #5
Concrete Outlet
Structure

Photo #6
View of Outlet
Channel from
Crest of Dam

REPRODUCED AT GOVERNMENT EXPENSE

Photo # 7

Emergency Spillway

Photo # 8

Upstream Reservoir

Outlet Structure

Photo # 9

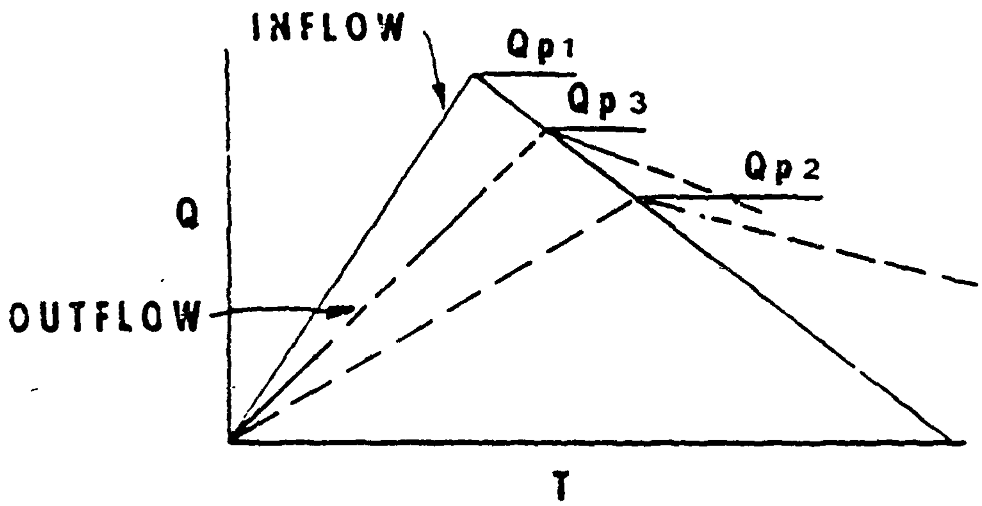
Center Road

Culverts

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

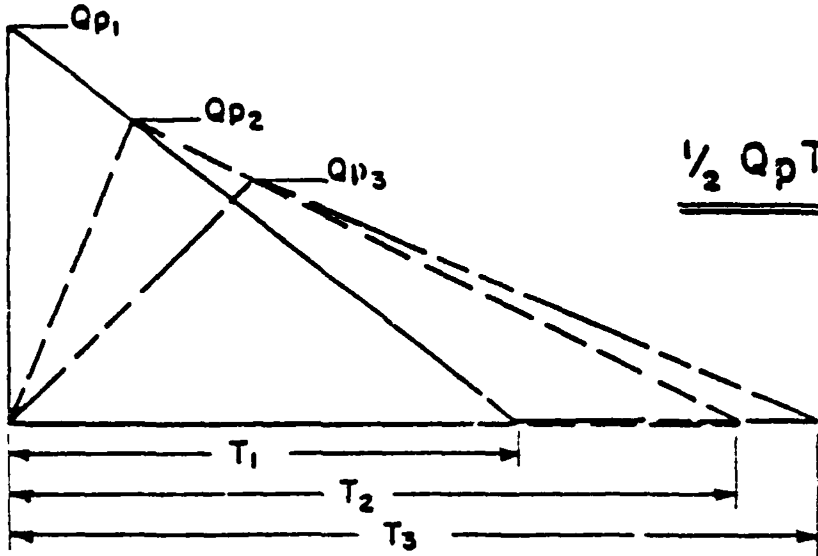
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore:

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$$\frac{1}{2} Q_p T = 12\,S$$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p_1} = \frac{8}{27} W_b \sqrt{g}\, Y_0^{\,3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Q_{p_2}(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_{ave}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072 -004 Sheet 1 of 14

Subject WEBSTER BROOK RES. FLOOD ROUTING By T. Otova Date 1-27-81

CURVE FITTING Chd. Rev.

I	X(I)	Y(I)
1	2553.0000	585.0000
2	2700.0000	585.5000
3	2800.0000	585.9000
4	2900.0000	586.4000
5	3000.0000	586.2000
6	3100.0000	587.2000
7	3200.0000	587.5000
8	3300.0000	588.0000
9	3400.0000	588.3000
10	3500.0000	589.5000
11	3630.0000	588.6000

ANOV. LOG REG: CODE 2

SOURCE	DF	SS	MS	F
TOTAL	10	15.7		
REG	1	15.4	15.4	499.0
RESID	9	0.3	0.0	

R SQUARE = 0.982

YHAT= 492.907+ 11.717LOG X

X(I)	YHAT
2500.00	584.58
2600.00	585.04
2700.00	585.49
2800.00	585.91
2900.00	586.32
3000.00	586.72
3100.00	587.10
3200.00	587.48
3300.00	587.84
3400.00	588.19
3500.00	588.53
3600.00	588.86
3700.00	589.18
3800.00	589.49
4000.00	590.09
4100.00	590.38
4200.00	590.66
4300.00	590.94
4400.00	591.21
4500.00	591.47
4600.00	591.73
4700.00	591.98
4800.00	592.23
4900.00	592.47
5000.00	592.71
5100.00	592.94
5200.00	593.17
5300.00	593.39
5400.00	593.61
5500.00	593.82
5600.00	594.03

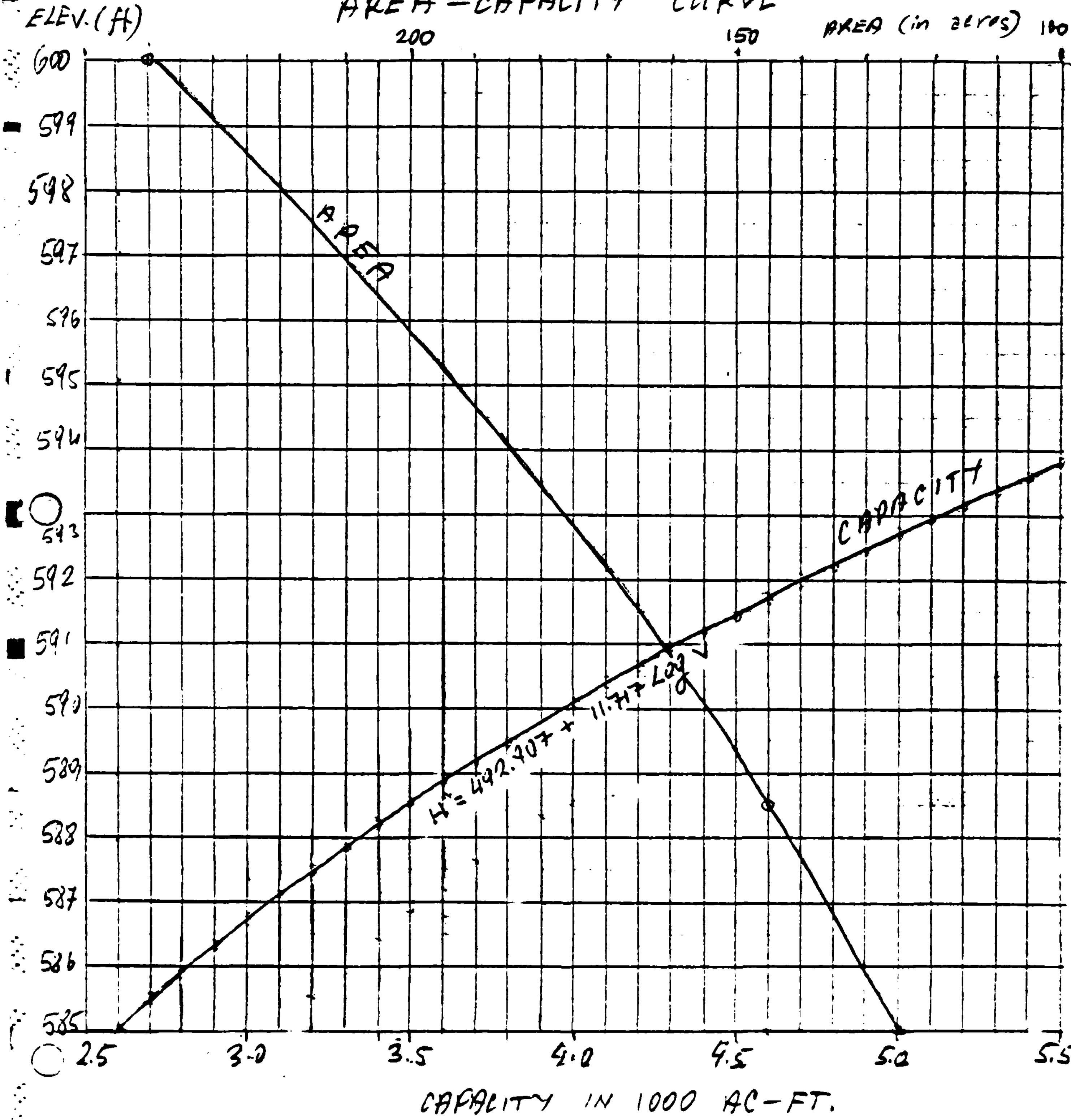
MAIN

Client CORPS OF ENGINEERS Job No. BUC-072-004 Sheet 2 of 14

Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-27-81

FLOOD ROUTING Ckd. Rev.

AREA — CAPACITY CURVE



MAIN

Client CORPS OF ENGINEERS Job No. 1345-072-004 Sheet 3 of 14
Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-28-81
FLOOD ROUTING Ckd. Rev.

Drainage Area = 4.06 sq. mi.

For rolling terrain $q_{PMF} = 1850$ cfs

These results are based on 19" runoff.

The Depth-Area-Duration curves yield 13" of runoff for the area considered and this is used in the calculations insted of 19" as is shown in Corps of Engineers Guidelines.

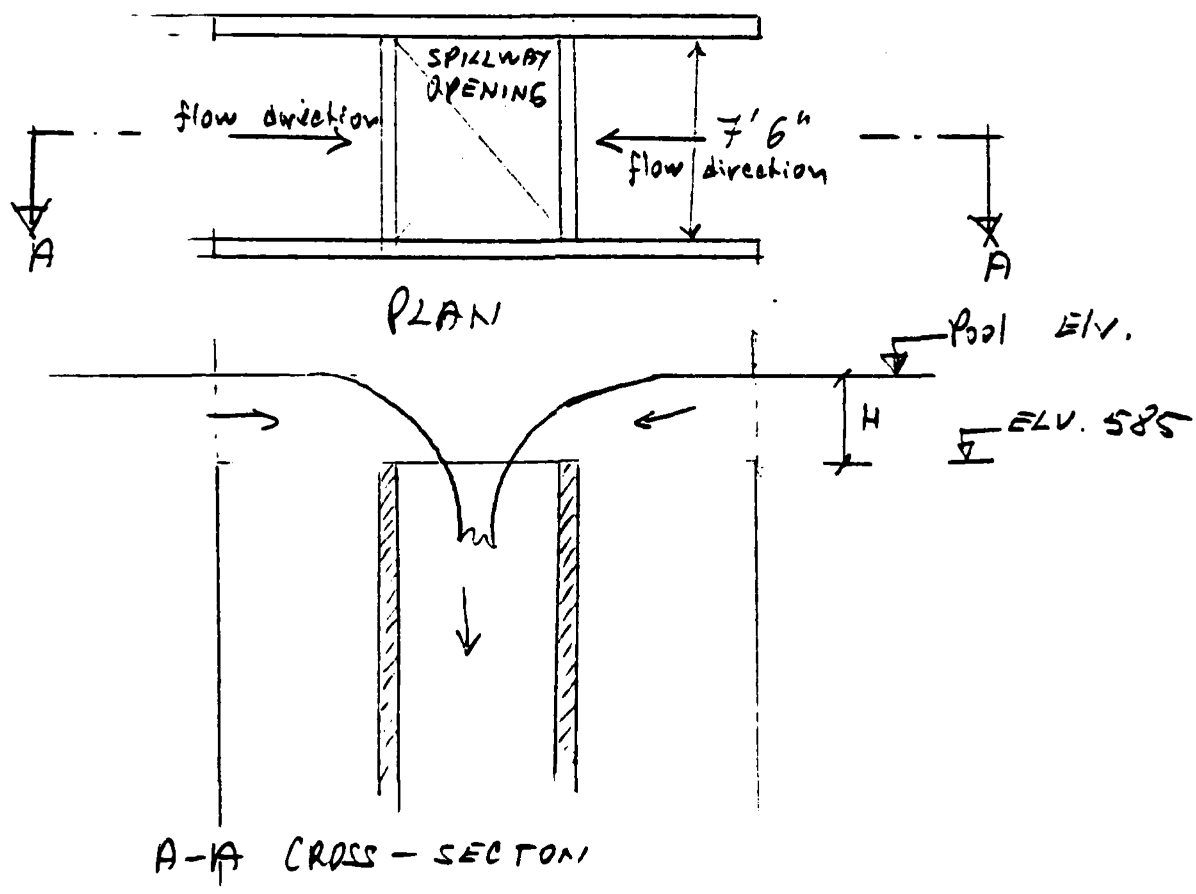
$$\text{New } q_{PMF} = 1850 \times \frac{13''}{19''} = 1265.8 \text{ cfs}$$

$$Q_{\text{Test flood}} = 1265.8 \times 4.06 = 5139 \text{ cfs.}$$

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072-004 Sheet 3A of 14
Subject WEBSTER BROOK By T. OTOVA Date 6-25-80
FLOOD LEVEL CALCULATIONS Ckd. Rev.

CALCULATION OF THE POOL ELEVATION FOR 208 cfs DISCHARGE FROM THE PRINCIPAL SPILLWAY:



$L = 7.5\ ft \times 2 = 15.0\ ft.$ $C = 3.3$ (Spillway Coef)

$$H = \left(\frac{Q}{C \times L}\right)^{2/3}$$

$$H = \left(\frac{208}{3.3 \times L}\right)^{2/3} = 2.6\ ft.$$

Pool Elv = 585 + 2.6 = 587.6 ft.

MAIN

Client: CORPS OF ENGINEERS — Job No. 1345-072-004 — Sheet 3B of 14

Subject: WEBSTER BROOK — By: T. OTOVA — Date: 4-25-80

FLOOD LEVEL CALCULATIONS — Ckd. — Rev.

PIPE SPILLWAYS

PRINCIPAL SPILLWAY

The formula used in these calcul
ations is presented in the Burea
u of reclamation's
DESIGN OF SMALL DAMS (1977)
Page 567,Figure B-10

```
Ht = [ 2.5204*(1+Ke)/D^4 +
466.18*n2*L/D^(16/3) ]*(Q/10)^2
```

Where,

Ht = Head in feet
Ke = Entrance loss coefficient
D = Diameter of pipe in feet
n = Mannings roughness coeffici
ent
L = Lenght of culvert in feet
Q = Design discharge rate in cf
s

The results prove that the controling structure is 30" ϕ pipe.

Ke = .3

D = 2.5 (ft)

n = .01

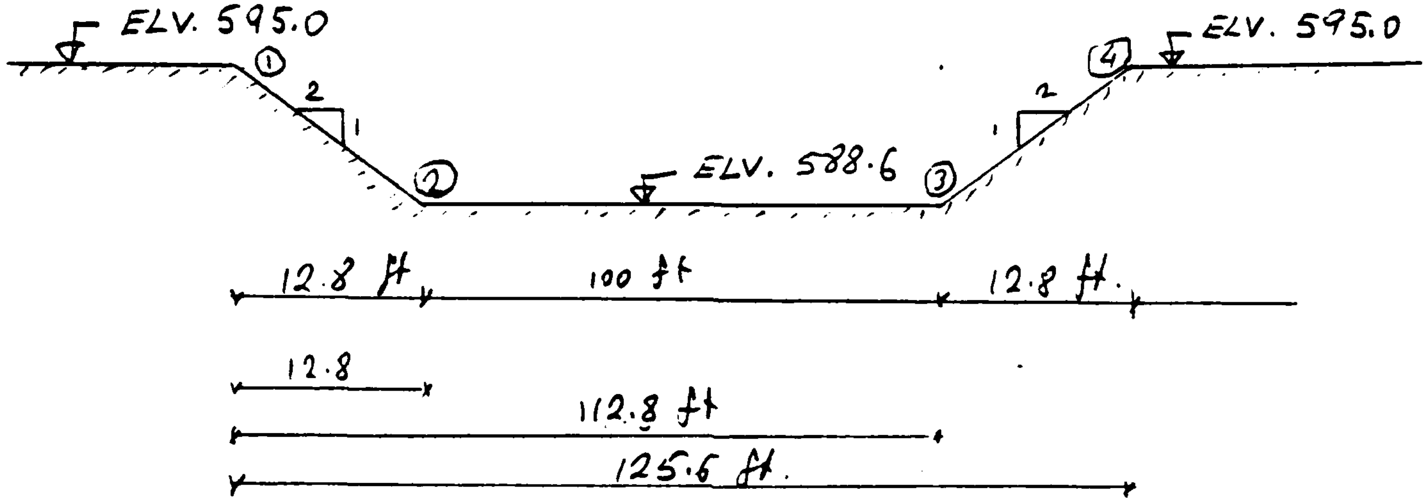
L = 233 (ft)

ENTRANCE ELV = 595 (ft)

OUTLET ELV = 531 (ft)

ELEVATION (ft)	DISCHARGE (cfs)
534.75	200
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

EMERGENCY SPILLWAY:



$$Q = \frac{1.49 \times A \times R^{2/3} \times S^{1/2}}{n}$$

Slope $S = 0.04$
Assumed $n = 0.03$
An open channel flow was assumed as being more conservative.
By using Slope-Area computer program the rating curve of the emergency spillway was derived, which is shown in the next page.
A curve fitting analysis was performed and the exponential formula of the curve was found to be

$$H_{ELV} = 0.0183287 \times V_{(ac-ft)}^{0.5816837} + 588.6$$

MAIN

Client: CORPS OF ENGINEERS | Job No. 1345-072-004 | Sheet 5 of 14

Subject: WEBSTER BROOK RESERVOIR | By T. OTOVA | Date 1-2-81

FLOOD ROUTING | Chkd. | Rev.

SLOPE-AREA METHOD

NO OF CROSS-SEC POINTS = 4

SLOPE = .04

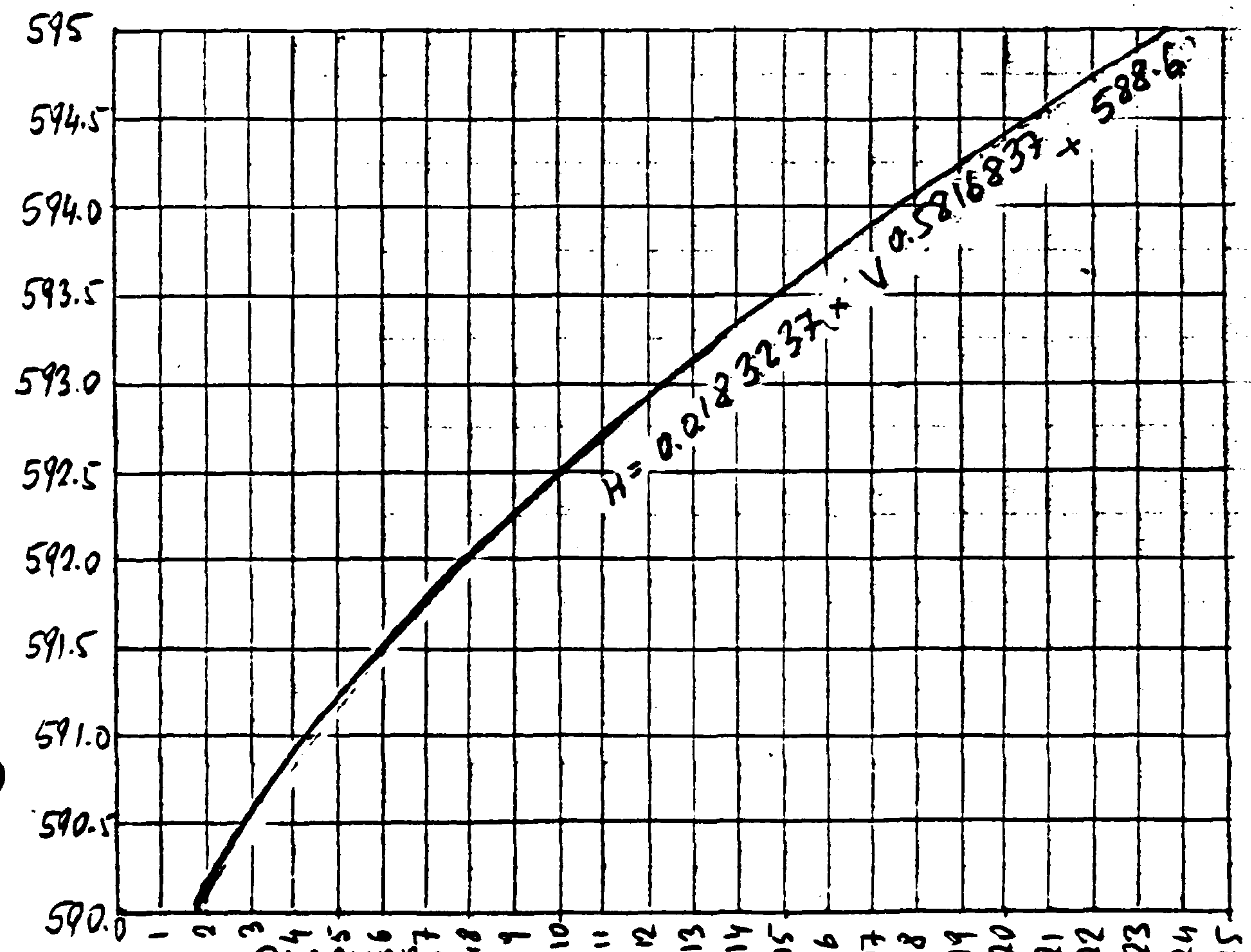
H(1)= 595
H(2)= 588.6
H(3)= 588.6
H(4)= 595

L(1)= 0
L(2)= 12.8
L(3)= 112.8
L(4)= 125.6

N(1)= .03
N(2)= .03
N(3)= .03

W.S. ELEV.	DISCHARGE
590	1768.8
591	4393.4
592	7940.1
593	12339.6
594	17552.9
595	23554.7

EMERGENCY SPILLWAY RATING CURVE



DISCHARGE IN 1000 CFS

MAIN

Client CORPS OF ENGINEERS Job No. 1345-072-004 Sheet 6 of 14
Subject WEBSTER BROOK RESERVOIR By T. OTOVA Date 1-28-81
FLOOD ROUTING Chkd. Rev.

ESTIMATING

EFFECT OF SURCHARGE STORAGE

ON MAXIMUM PROBABLE DISCHARGES

These calculations are performed according to the Corps of Engineers Guidelines

WEBSTER BROOK DAM

D A T A :

DRAINAGE AREA,
A= 4.06 (sq.mi.)

PEAK INFLOW,
Qp1= 5139 (cfs)

PRINCIPAL SPILLWAY CREST ELEV.,
EL 1= 585 (ft.)

EMERGENCY SPILLWAY CREST ELEV.,
EL 2= 588.6 (ft.)

Emergency Spillway Rating Curve is defined as ,

H = a * Q ^ b

a = .0182287
b = .5816837

The Capacity - Elv. curve is defined as,

Elv = m + n * Log(Volume

m= 492.907
n= 11.717

TOTAL PMF RUNOFF,
R= 17 (in.)

CALCULATIONS:

S T E P 1

Reduction of the Qp1 due to starting elevation at Principal Spillway crest elev.

Volume at 585 (ft.)

Volume1 =Exp((ELV1-m)/n)
Volume1 = 2590.94 (ac-ft)

Volume at 588.6 (ft.)

Volume2 =Exp((ELV2-m)/n)
Volume2 = 3522.838 (ac-ft)

Diff. of Volumes,

Diff.Volume = 931.897 (ac-ft)
or,
Diff.Volume, D= 4.3 (in.)

NEW Qp1=Qp1*(1-D/R)
NEW Qp1 = 3437 (cfs)

S T E P 2

Surcharge Height,

H = a * Qp1 ^ b
H = 2.08 (ft.)

Surcharge Volume,

ELV=ELV2 + H
ELV= 590.68 (ft.)

Volume = 4210.705 (ac-ft)

STOR1 =Volume - Volume2

STOR1 = 687.867 (ac-ft)
or,
STOR1 = 3.17 (in.)

MAIN

Client: CORPS OF ENGINEERS
Job No. 1345-072-004 Sheet 7 of 14
Subject: WEBSTER BROOK RESERVOIR FLOOD ROUTING
By T. OTOVIA Date 1-28-81
Chkd. ____ Rev. ____

Corresponding Discharge:

Qp2 = Qp1*(1-STOR1/R)
Qp2 = 2597 (cfs)

STEP 3

Surcharge Height:

H = a * Qp2 ^ b
H = 1.77 (ft.)

Surcharge Volume,STOR2:

ELV = ELV2 + H
ELV = 590.37 (ft.)

Volume = 4099.254 (ac-ft)

Diff Volume = Volume - Volume2
Diff Volume = 576.416 (ac-ft)
or
STOR2 = 2.56 (in.)

OLD STOR.AVE.= (STOR1 + STOR2) / 2
OLD STOR.AVE.= 2.91 (in.)

Qp3 =Qp1*(1 - OLD STO.AVE. / R)
Qp3 = 2665 (cfs)

STEP 4

Surcharge Height

H3 = a * Qp3 ^ b
H3 = 1.8 (ft.)

Diff Volume STOR3:

E1 = H3 + H2
E1 = 590.4 (cfs)
Volume = Exp((E1-m)/n)
Volume = 4108.68 (ac-ft)

STOR3 = Volume - Volume2
STOR3 = 585.842 (ac-ft)
or
STOR3 = 2.7 (in.)

NEW STO.AVE.= (OLD STO.AVE. + STOR3) / 2
NEW STO.AVE.= 2.81 (in.)

Qp4 = Qp1 * (1 - NEW STO AVE. / R)
Qp4 = 2693 (cfs)

Surcharge Height

H4 = a * Qp4 ^ b
H4 = 1.81 (ft.)

E2 = H4 + H2
E2 = 590.41 (ft.)

CHEKING:

E3 - E2 = .01 (ft.)

RESULTS:

AVERAGED DISCHARGE= 2679 (cfs)

WATER SURFACE ELEV.= 590.4 (ft.)

SURCHARGE HEIGHT = 1.8 (ft.)

CREST ELEV. OF THE DAM:
Ec= 595 (ft.)

VOLUME AT DAM CREST ELEV.:
Vc = 6082.902 (ac-ft)

VOLUME AT MAX.WATER SURFACE ELEV

Vw = 4110.626 (ac-ft)

MAIN

Client CORPS OF ENGINEERS Job No. 1345-077-004 Sheet 8 of 14

Subject WEBSTER BROOK DAM By T. OTOVA Date 1-28-81

FAILURE ANALYSES Ckd. Rev.

WEBSTER BROOK
DAM FAILURE ANALYSES

These calculations are performed according to the RULE OF THUMB procedures of the Corps of Engineers

The breach discharge:
Qp1 = 8/27 * Wb * g^0.5 * Yo^3/2

Where,

Yo is the height of the breach (from river bed to the max. pool level)

Wb is 35% of the length of the dam, or Wb = .35 * Wd

g is the acceleration of the gravity (32.2 ft/sec^2)

Yo = 61.4 (ft)

Wd = 550 (ft)

Wb = 193 (ft)

From above equation
Qp1 = 155717 (cfs)

The natural channel cross sections are simplified as triangular cross sections

The stage-discharge relationship becomes as,

h = [1.068 * n * Tan(a) * Q / Cos(a)^2/3 / S^.5]^3/8 ...(I)

Where,

Q = Discharge (cfs)
a = Side slope angle (deg)
S = Channel slope

The cross section Area:

A = h^2 * Tan(a) ...(II)

The Volume of the Reservoir:
V = 4110 (ac-ft)
or
V = 179031600 (cub-ft)

MAIN

Client CORPS OF ENGINEERS — Job No. 1345-172-004 Sheet 9 of 14

Subject WEBSTER BROOK DAM FAILURE ANALYSES — By T. OTOVA Date 1-28-81

Ckd. ____ Rev. ____

R E A C H (1) CALCULATIONS

Test flood discharge.
Qt = 2679 (cfs)

a = 3.81 (deg)
S = .005
r = .07
L = 500 (ft)

From Formula (I),

Prefailure height,

h1 = 7.1 (ft)

From Formula (II) ,

A1 = 755 (sq.ft)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 32.9 (ft)

From Formula (II),
Total Area,
A = 16314 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 15549 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 7774557 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 148955 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 151634 (cfs)

h = 32 (ft)

From Formula (II),

A = 15789 (ft)

Residual Area,

A2 = A - A1

A2 = 15023 (ft)

V2 = A2 * L

V2 = 7511960 (cub-ft)

Vavg = (V1 + V2) / 2

Vavg = 7643259 (cub-ft)

Qp2 = Qp1 * (1 - Vavg / V)

Qp2 = 149069 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 32.4 (ft)

RESULTS :

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 32.4 (ft)

3) Breach Discharge = 149069 (cfs)

4) Reach Length = 500 (ft)

MAIN

Client CORPS OF ENGINEERS — Job No. 1305-072-004 — Sheet 10 of 14
Subject WEBSTER BROOK DAM — By T OTOVA — Date 1-28-81
FAILURE ANALYSES — Chk. — Rev.

R E A C H (2) CALCULATIONS

Test flood discharge:
Qt = 2679 (cfs)

s = 3.81 (deg.)
S = .005
n = .07
L = 500 (ft)

From Formula (I),

Prefailure height,

h1 = 7.1 (ft)

From Formula (II),

A1 = 765 (sq.ft.)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 32.4 (ft)

From Formula (II),
Total Area,
A = 15797 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 15032 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 7516419 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 142811 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 145490 (cfs)

h = 31 (ft)

From Formula (II),

A = 15306 (ft)

Residual Area,

A2 = A - A1

A2 = 14541 (ft)

V2 = A2 * L

V2 = 7270806 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 7393613 (cub-ft)

Qp2 = Qp1 * (1 - Vave / V)

Qp2 = 142913 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 31.9 (ft)

RESULTS

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 31.9 (ft)

3) Breach Discharge = 142913 (cfs)

4) Reach Length = 500 (ft)

MAIN

Client: *CORPS OF ENGINEERS* Job No. *1345-072-004* Sheet *11* of *14*

Subject: *WEBSTER BROOK DAM FAILURE ANALYSES* By *T. OTOVA* Date *1-28-81*

Chkd. ____ Rev. ____

R E A C H (3) CALCULATIONS

Test flood discharge
Qt = 2679 (cfs)

z = 3.81 (deg.)
S = .005
n = .07
L = 500 (ft)

From Formula (I),

Prefailure height,

h1 = 7.1 (ft)

From Formula (II),

A1 = 765 (sq.ft.)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 31.9 (ft)

From Formula (II),
Total Area,
A = 15314 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 14549 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 7274840 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 137106 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 139785 (cfs)

h = 31 (ft)

From Formula (II),

A = 14854 (ft)

Residual Area,

A2 = A - A1

A2 = 14089 (ft)

V2 = A2 * L

V2 = 7044607 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 7159724 (cub-ft)

Qp2 = Qp1 * (1 - Vave / V)

Qp2 = 137198 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 31.4 (ft)

RESULTS :

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 31.4 (ft)

3) Breach Discharge = 137198 (cfs)

4) Reach Length = 500 (ft)

Client	*CORPS OF ENGINEERS*	Job No. *1345-072-004*	Sheet *12* of *14*
Subject	*WEBSTER BRIDE DAM*	By *T. OTOVA*	Date *1-28-81*
	FAILURE ANALYSES	Ckd.	Rev.

R E A C H (4) CALCULATIONS

Test flood discharge.
Qt = 2679 (cfs)

a = 7.81 (deg.)
S = 005
n = 07
L = 500 (ft)

From Formula (I),

Prefailure height,

h1 = 7.1 (ft)

From Formula (II) ,

A1 = 765 (sq.ft.)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 31.4 (ft)

From Formula (II),
Total Area,
A = 14861 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 14096 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 7048269 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 131796 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 134475 (cfs)

h = 30 (ft)

From Formula (II),

A = 14429 (ft)

Residual Area,

A2 = A - A1

A2 = 13664 (ft)

V2 = A2 * L

V2 = 6832008 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 6940138 (cub-ft)

Qp2 = Qp1 * (1 - Vave / V)

Qp2 = 131879 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 31 (ft)

RESULTS :

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 31 (ft)

3) Breach Discharge = 13187[illegible] (cfs)

4) Reach Length = 500 (ft)

MAIN

Client: CORPS OF ENGINEERS — Job No. 1345-072 — Sheet 13 of 14

Subject: WEBSTER BROOK DAM FAILURE ANALYSES — By: T. OTOVA -004 — Date: 1-28-81

Ckd. ______ Rev. ______

R E A C H (5) CALCULATIONS

Test flood discharge.
Qt = 2579 (cfs)

a = 7.91 (deg.)
S = 005
n = 07
L = 500 (ft)

From Formula (I),

Prefailure height,

h1 = 7.1 (ft)

From Formula (II) ,

A1 = 765 (sq.ft.)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 31 (ft)

From Formula (II),
Total Area,
A = 14435 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 13670 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 6835341 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 126844 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 129523 (cfs)

h = 30 (ft)

From Formula (II),

A = 14028 (ft)

Residual Area,

A2 = A -.A1

A2 = 13263 (ft)

V2 = A2 * L

V2 = 6631812 (cub-ft)

Vave = (V1 + V2) / 2

Vave = 6733577 (cub-ft)

Qp2 = Qp1 * (1 - Vave / V)

Qp2 = 126919 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 30.5 (ft)

RESULTS

1.) Prefailure Height = 7.1 (ft)

2.) Postfailure Height = 30.5 (ft)

3.) Breach Discharge = 126919 (cfs)

4.) Reach Length = 500 (ft)

R E A C H (6) CALCULATIONS

Test flood discharge:
Qt = 2679 (cfs)

a = 3.81 (deg.)
s = 005
n = 07
L = 500 (ft)

From Formula (I),

Prefailure height,

hf = 7.1 (ft)

From Formula (II),

A1 = 765 (sq.ft.)

Q = Qp1 + Qt

From Formula (I),
Total Height,
h = 30.5 (ft)

From Formula (II),
Total Area,
A = 14034 (sq-ft)

Residual Area,
A2 = A - A1
A2 = 13269 (sq-ft)

Residual Volume,

V1 = L * A2

V1 = 6634856 (cub-ft)

Qp2 = Qp1 * (1 - V1 / V)

Qp2 = 122215 (cfs)

From Formula (I),

Q=Qp2+Qt

Q = 124894 (cfs)

h = 30 (ft)

From Formula (II),

A = 13651 (ft)

Residual Area,

A2 = A - A1

A2 = 12885 (ft)

V2 = A2 * L

V2 = 6442960 (cub-ft)

Vavg = (V1 + V2) / 2

Vavg = 6538908 (cub-ft)

Qp2 = Qp1 * (1 - Vavg / V)

Qp2 = 122283 (cfs)

From Formula (I),

Q = Qp2 + Qt

h2 = 30.1 (ft)

RESULTS
----

1) Prefailure Height = 7.1 (ft)

2) Postfailure Height = 30.1 (ft)

3) Breach Discharge = 122283 (cfs)

4) Reach Length = 500 (ft)

APPENDIX E

INFORMATION AS CONTAINED IN THE

"NATIONAL INVENTURY OF DAMS IN THE UNITED STATES"

NOT AVAILABLE AT THIS TIME

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